Periodical

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

C. LIBRARY
EB 24 1943
DETROIT

SCHOOL SHOP ANNUAL

MARCH, 1943 VOL. 32, No. 3

Photo: American Optical Co.

. . . and Better Men for Tomorrow

THE device pictured above is a Phoroptor, a remarkable eyesight testing device. It contains only 36 lenses, yet these lenses can be manipulated so as to produce more than 61 billion different eyeglass prescriptions. Astounding as this device is, it is but an illustration of a principle that is found throughout the universe. For example, there are less than 100 known elements, yet out of these few are produced the range, scope, nature and characteristics of the entire universe reaching millions of light years into space. Each man inherits only 48 chromosomes, yet out of these few come the infinite variety of racial and physical characteristics that make up the billions of mankind.

Similarly there are only a few influences that shape and mold the future of human beings. Yet these influences almost wholly determine the individual's position in later years on that infinite scale that reaches from dismal failure at one end to complete, happy, and rounded success at the other. Hence it is of vital importance to everyone who shares the responsibility of shaping the lives of today's children and tomorrow's citizens that the influences of the formative years be carefully chosen and effectively employed.

It is not a matter of exaggeration but of soundest common sense to say, for example, that the drawing instruments used by a lad in his mechanical drawing classes can be powerful influences for better or for worse. These drawing instruments are likely to be the first instruments in precise thinking, judgment and workmanship the youngster has ever used. They often represent his introduction to the realm where boyish flights of fancy are harnessed to the practical means of achievement, that realm where dream and reality first are joined. Here are instruments that help him to set standards, to distinguish between shoddy workmanship and ideals and good. To say that his boyish fancy can be stirred, captured and made creative by drawing instruments that are cheaply made, carelessly chosen, held in light esteem by his instructor is to deny all the known facts of psychology. Let *these* instruments of creation be chosen carefully, let *them* be the best the boy can afford.

EUGENE DIETZGEN CO.

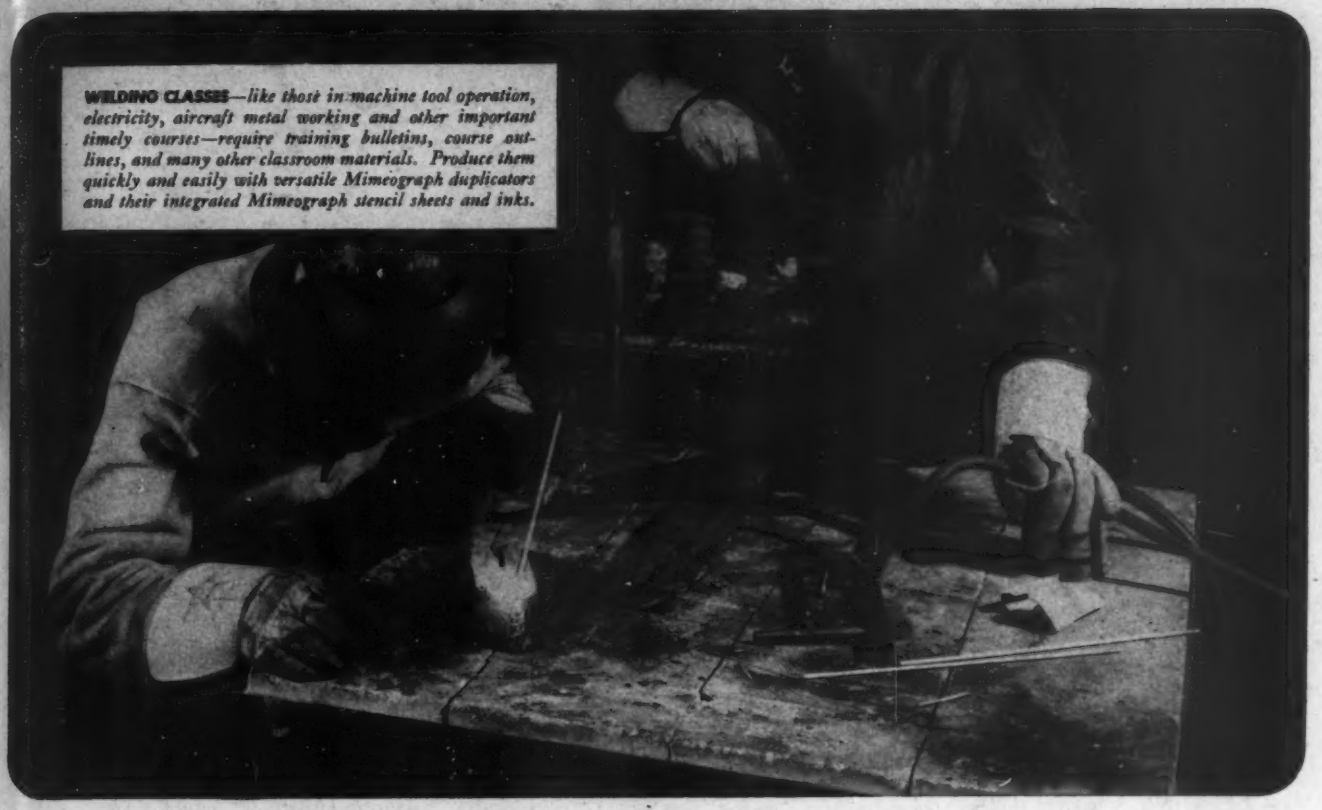
Chicago • New York • San Francisco • New Orleans • Pittsburgh
Los Angeles • Philadelphia • Washington • Milwaukee
Dealers in All Principal Cities

DIETZGEN

EVERYTHING FOR DRAFTING AND SURVEYING

Your Requirement vs. NATIONAL SECURITY

● The demand for Dietzgen Drawing Instruments today greatly exceeds the present available supply. First, the national wartime requirements are making a tremendous demand on our production capacity. Second, the critical materials used in making Dietzgen quality instruments impose a drastic limitation on production for other than the needs of our armed forces and essential war production. Your tolerant understanding of this situation is appreciated.



WELDING CLASSES—*like those in machine tool operation, electricity, aircraft metal working and other important timely courses—require training bulletins, course outlines, and many other classroom materials. Produce them quickly and easily with versatile Mimeograph duplicators and their integrated Mimeograph stencil sheets and inks.*

Vocational Education Helps Solve the "Man Power Shortage"

The shortage of man power—one of the most serious problems confronting the nation today—is a direct challenge to vocational education.

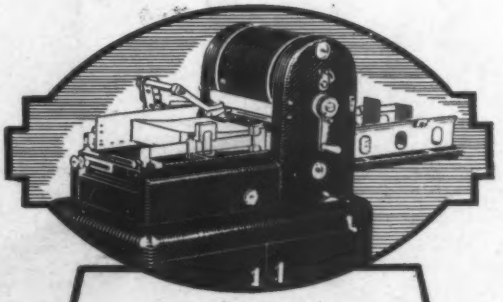
You teachers of the industrial arts have already seen your programs expanded and enrollments doubled in fifteen months of war. Now you must accept as your continuing responsibility the education and training of millions more workers so urgently needed by our country.

Ready to work with you . . . ready to help you shoulder the increased burden of these requirements . . . are Mimeograph duplicators.

You can ease the burden of larger classes and keep instruction more individualized with the help of Mimeograph duplication. You can use the visual instruction materials that help make your teaching more effective. In fields where textbooks are not available, specialized text material can easily be produced and adapted to the needs of local industry.

Be sure to make the fullest use of your school's Mimeograph equipment. Let it help lighten the teaching burden for you. Telephone the Mimeograph distributor in your community—or write A. B. Dick Company, Chicago.

Now obtainable without a preference rating — the Mimeograph photochemical printer—Give every pupil his own copy of project drawings and other essential visual materials. The Mimeograph photochemical printer provides a new method of making duplicate copies of ink tracings, in quantity, at very low cost. Call the Mimeograph distributor nearest you for complete details.



Mimeograph duplicator

MIMEOGRAPH is the trade-mark of A. B. Dick Company, Chicago, registered in the U. S. Patent Office.

14" swing, South Bend Toolroom Lathe
13" swing, South Bend Engine Lathe
10" swing, South Bend Engine Lathe
9" swing, South Bend Engine Lathe
Series 1000, 10" swing, South Bend Turret Lathe
14½" swing, South Bend Toolroom Lathe

SOUTH BEND LATHES

Engine Lathes · Toolroom Lathes · Turret Lathes

Save time and manpower for vital production work through practical shop training. The thousands of new lathe operators that war industries must have will produce better work sooner if they are trained on the right lathes—the kind industry uses. They can then step into their new jobs able to operate their machines properly and will require a minimum of supervision.

Because of the widespread use of South Bend Lathes in industry for both production and toolroom work, they are effective equipment for training purposes. In addition, their ease of operation, ruggedness and safety features contribute to their popularity in school shops.

South Bend Lathes are made in a range of sizes that will meet all school shop requirements. The Engine Lathes and Toolroom Lathes are available in 9″, 10″, 13″, 14½″, and 16″ swings. The Turret Lathes have 9″ and 10″ swings. A copy of Catalog 100-C describing these lathes will be sent upon request.

SOUTH BEND LATHE WORKS
South Bend, Indiana — Lathe Builders for 36 Years

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION, March, 1943, Volume 32, No. 3. Published monthly, except during July and August, by The Bruce Publishing Co., Milwaukee, Wis. Entered January 2, 1914, as Second-Class matter at Milwaukee, Wis., under Act of March 3, 1879. Subscriptions — U. S., $2.50 per year. Canada and Foreign, $3.00. Single copies, 35 cents.

Speed WAR PRODUCTION TRAINING

USE THESE BOOKS AND FILMS ON LATHE OPERATION

Today's big problem is the training of machinists for the thousands of new jobs in war industries and to replace the men who have gone into the armed forces. Production goals have been increased, yet standards of precision and quality must be maintained even with these new workers. To accomplish this, a vast army of men and women must acquire new skills in the shortest possible time.

To help you train new lathe operators, we offer the practical aids listed below. These books and films on lathe operation and care have proved effective in hundreds of apprentice training schools, including Army and Navy training stations.

Write for Information on These Practical Training Helps

MOTION PICTURES—"The Lathe" and "Plain Turning"—two new 16 mm sound films in color on the basic principles of engine lathe operation. Available on a free loan basis. Showing time 20 minutes each. Write for circular.

HOW TO GET THE MOST OUT OF YOUR LATHE—Specialized service bulletins on the care and operation of engine lathes. H-1, "Keep Your Lathe Clean"; H-2, "Oiling the Lathe"; H-3, "Installing and Leveling the Lathe"; H-4, "Keep Your Lathe in Trim." Sample copies mailed on request.

HOW TO RUN A LATHE—A practical 128 page handbook on the operation and care of metal working lathes. Contains 360 illustrations. Written in a non-technical style easy for the beginner to understand. Used as a shop text book by the Army, Navy, Air Corps, and countless schools. Price 25c. Sample copy free to shop instructors.

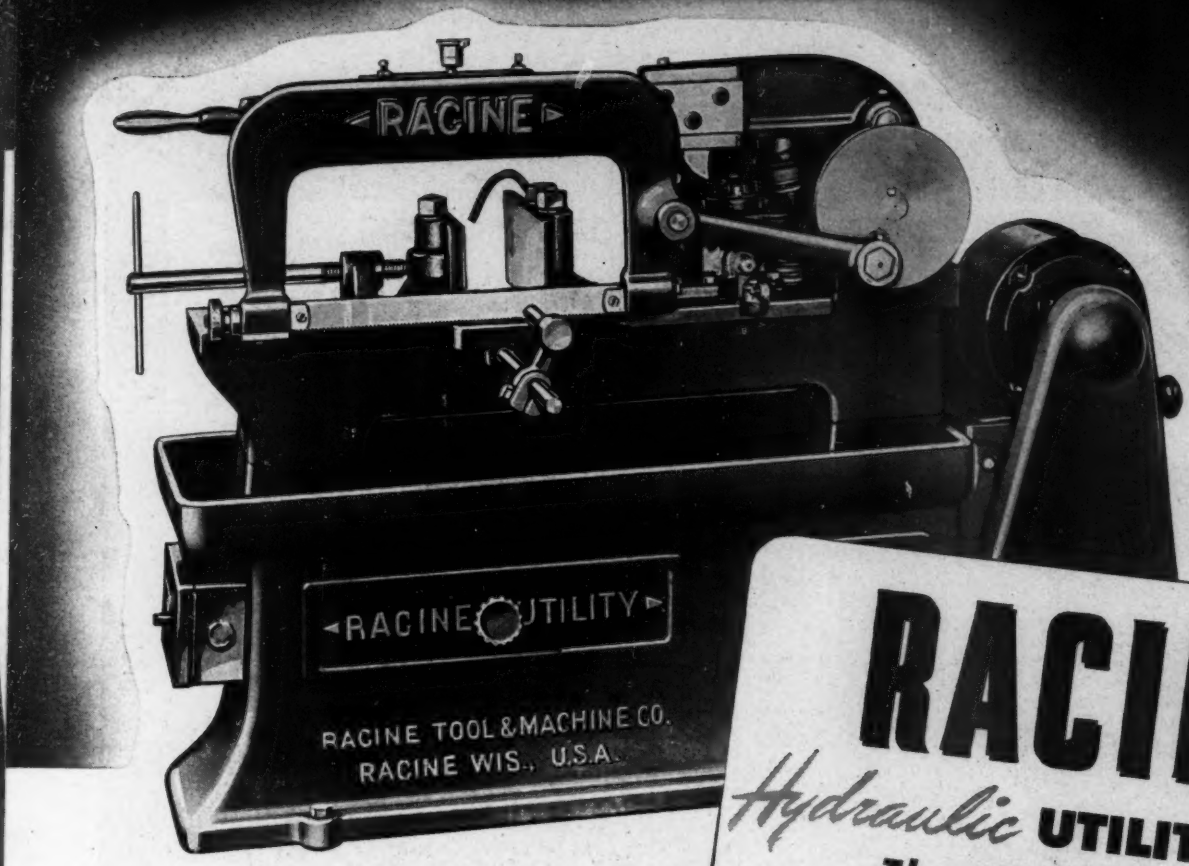
THREAD CUTTING—A 21 page book on how to set up a lathe for cutting various screw threads; setting cutter bits; thread formulae; metric threads, etc. Price 10c. Sample copy free to shop instructors.

GRINDING CUTTER BITS—12 page book on grinding lathe tool cutter bits. Covers identification and application of various bits, methods of grinding, correct angles, etc. Price 10c. Sample copy free to shop instructors.

ARMY E NAVY

SOUTH BEND LATHE WORKS

LATHE BUILDERS FOR 36 YEARS SOUTH BEND, INDIANA



RACINE

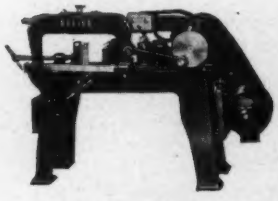
Hydraulic UTILITY SAWS

The Modern Saws for Modern Training

TODAY, vocational students require equipment that will give them the fundamental training necessary to operate the metal-cutting machines now being used by modern industry, arsenals, air bases and shipyards.

Racine Utility Saws better accomplish this because they embody in simplified form the principles of hydraulic design and controls found in Racine larger production machines.

Two models are available—Wet or Dry Cut. Capacity 6" x 6".



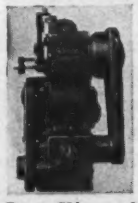
DRY CUT MODEL

Racine Hydraulic Utility Saw

Includes all the outstanding features described for the Wet Cut Model above, with the exception of the cooling system. A low cost metal cutting saw for all around shop use.

Racine's Metal Cutting Machine Models are available in capacities 6" x 6" to 20" x 20".

These Features Make Racine Saws SAFE AND EASY TO OPERATE



Rear View of Utility Saw showing complete guarding of drive.

DRIVE UNIT

All revolving parts are completely guarded to protect inexperienced operators from injury.

SAW FRAME AND GUIDE

The Guide Arm on which the Saw Frame slides gives exceptional bearing surface. Frame and Guide are counterbalanced and cannot fall.

Simple and compact Hydraulic Unit—easily removable.

HYDRAULIC UNIT

The Hydraulic feed and control system is leak-proof and packless. Nothing to wear out or get out of adjustment. All interior parts are self-lubricated. Pressures are controlled by a single graduated dial. There are no trains of gears, levers or ratchet devices to get out of adjustment.

RACINE *Variable Volume* OIL HYDRAULIC PUMPS AND VALVES

A Modern Source of Hydraulic Force

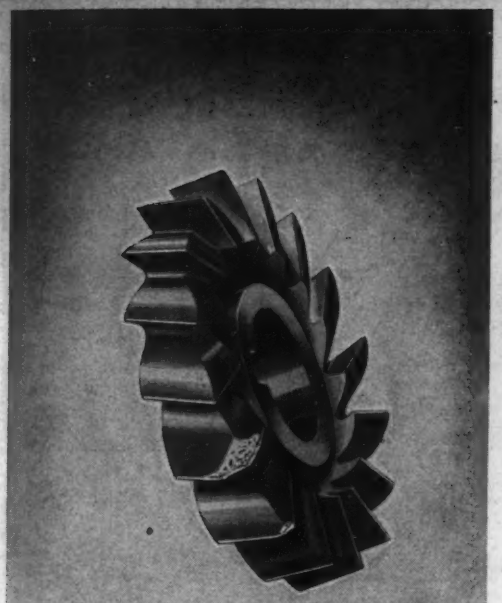
For use where force is required for bending, forming, pressing, feeding, clamping, holding, molding and many other applications. Hydraulic "Sleeve Type" Valves available with mechanical, electrical or manual operating devices.

Complete information and prices gladly furnished on request. Address Dept. IA-S.

RACINE TOOL and MACHINE COMPANY

STANDARD FOR QUALITY AND PRECISION

RACINE, WISCONSIN · U. S. A.



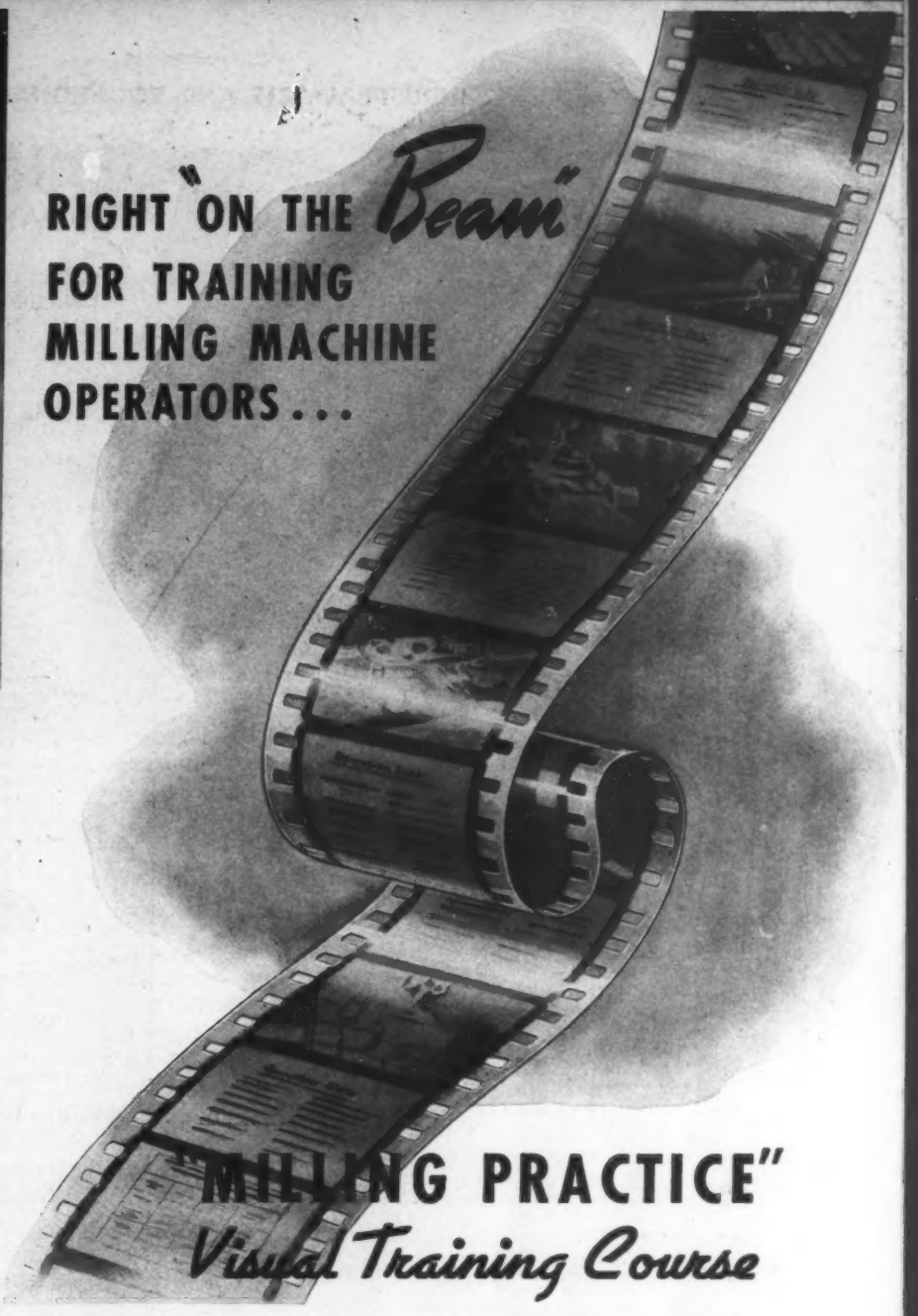
"Breaks" LIKE THIS ARE NO "BREAK" FOR PRODUCTION

Broken tools—mechanical troubles — caused by improper care and operation of machine tools, are no help in production for Victory. Practically every machine tool manufacturer offers valuable advisory service — "care and operation" handbooks — technical bulletins — on better methods of operation that help green men as well as speed and improve production of skilled workers.

Put full information in the hands of the men who operate your machine tools — teach them the "know how" to get the most in production with the least waste of time, effort and materials.

Buy Victory with at least 10% in War Bonds!

RIGHT "ON THE Beam" FOR TRAINING MILLING MACHINE OPERATORS...



"MILLING PRACTICE" *Visual Training Course*

This Visual Training Program, consisting of five sound-slide films dealing with the fundamentals of milling practice, continues to prove highly popular with technical instructors and industrialists everywhere. Interestingly arranged, the films show many types of operations such as T-slotting, angular and straddle milling, circular milling, dovetailing, boring and end milling.

Many shop training directors report unusually successful results with this visual course. It is available on a rental basis at nominal cost. We invite you to write for full information to our Department of Industrial Education.

Kearney & Trecker Products CORPORATION
MILWAUKEE, WISCONSIN
Subsidiary of Kearney & Trecker Corporation

Kearney & Trecker CORPORATION
Milwaukee, Wisconsin

TEACH The VALUE of QUALITY

Molding shop students into true *craftsmen*—respecters of fine work, fine materials, fine *tools*—is the most important job any shop instructor can have. . . . You'll start your charges in the right direction by specifying Morse Cutting Tools. For wherever *quality* is honored, the name of Morse is known and honored . . . "There IS a Difference!"

MORSE TOOLS FOR THE SCHOOL SHOP

(*above*) **No. 302 Taper Shank Drill.** Of selected carbon steel, for all power drilling not requiring high speed.

No. 330 Straight Shank Drill. So-called "Jobbers'" drill of carbon steel, for use in all types of hand drilling.

(*above*) **No. 602 Hand Reamer,** Spiral Fluted, carbon steel reamer, ideal for general hand use in the shop.

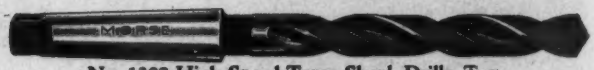
No. 717 Expansion Reamer. Available in 1/4" to 2" diameters. Its expansion feature makes it highly useful in school shop work.

No. 1045 Spiral Pointed Hand Tap. For machine tapping of most common materials in through holes. Furnished in plug style only.

No. 1184 Adjustable Round Die. In all sizes and threads, for hand thread cutting of commonly used metals.

The Morse Catalog is a valuable 256-page reference book on quality cutting tools. A free copy will be sent to Instructors and Superintendents requesting it on their official School or Shop Letterhead.

MORSE TOOLS FOR THE ADVANCED OR AUTOMOTIVE SHOP



No. 1302 High Speed Taper Shank Drills. Tempered and designed for steady production work in power-drilling machines. Diameter 1/8" to 3".

No. 1728 High Speed Adjustable Reamer. Six tapered blades slide lengthwise in slots, and are held in position for desired diameter.

No. 1683 High Speed Taper Pin Reamer. Helical Flutes. Taper 1/4" per foot. Indispensable in any work where taper pins are used.

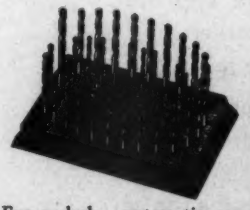
No. 495 Combined Drills and Countersinks. Made of Carbon Steel, in all popular sizes and types, for drilling and countersinking center holes, or for starting holes at an angle.

No. 773 Screw Extractor. A very useful tool for removing broken-off pieces of studs, bolts or screws from holes.

No. 1805 Heavy Duty End Mill. Coarse-toothed, spiral heavy-duty mill. Available in right-hand or left-hand types. **No. 1809 Alternate Tooth Milling Cutter.** Alternate teeth provide a shearing cut and ample chip clearance for deep slotting in tough metals.

No. 1040 Hand Tap. All popular sizes and pitches. Plug style illustrated.

No. 1145 Tap Wrench. Furnished in sizes 0 and 1, to handle all taps from 1/16" to 5/16", and reamers from 1/8" to 15/32".



For orderly, systematic arrangement of drills, Morse Drill Blocks and Drill Cases are ideal for the school shop.

MORSE THERE IS A DIFFERENCE TWIST DRILL & MACHINE COMPANY NEW BEDFORD - - - MASS., U. S. A.

THE MORSE LINE INCLUDES HIGH SPEED AND CARBON DRILLS - REAMERS - CUTTERS - TAPS and DIES - SCREW PLATES - ARBORS - CHUCKS - COUNTERBORES - MANDRELS - TAPER PINS - SOCKETS - SLEEVES

A Handful of Power!

-for America's Production Rookies

WHEN you train your students with the husky electric tools typified by the famous Black & Decker Holgun, you're giving them a better chance to "hike" their earning power upon graduation to jobs in war industry. It's no secret that over half of America's war plants today depend on Black & Decker Tools for faster and better production of the weapons Uncle Sam needs for Victory. Continually, we get reports from the men who train war industry's production rookies, such as: "We've found these tools exceptional for training riveters and sheet metal workers" . . . "Our school uses Black & Decker Drills exclusively in the training program for aircraft mechanics . . ."

Your students deserve to "get the feel" of war industry's favorite electric tools from the beginning of their careers. Your nearby Black & Decker Distributor will be glad to help you select the tools you need for your program. Get in touch with him now.

Lessons in Ingenuity

FREE Throughout war industry many producers have ingeniously combined brains and Black & Decker Tools to keep vital production rolling when special equipment could not be had. You teachers will find in this new booklet, "They Used Their Heads," many such ingenious adaptations. Write for your FREE copy to: The Black & Decker Mfg. Co., 780 Penna. Ave., Tawson, Md.

WINGS FOR VICTORY. Husky B & D Holguns speed drilling operations on airplane wing parts. There are more Holguns used in the aviation industry than any other electric drill.

BOAT FRAMES ARE NOTCHED quicker with this ¾" Holgun, specially equipped with a multi-spur. These versatile tools help solve many new wartime production problems.

TAPPING GOES ⅓ FASTER with Black & Decker Tapgun than by former method, reports plant operator. The Tapgun saves time, labor—keeps running on hard schedules.

THOUSANDS OF SCREWS on thousands of boats are driven faster and more accurately when B & D Scruguns go to work. The Scrugun is widely used in small boat production.

"ELECTRIC MOTOR production speeded up with Black & Decker Scruguns," says motor manufacturer. On all multiple screw driving or nut running operations, Scruguns save time.

Get in the Scrap with Your Scrap Now!

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC **TOOLS**

FURNACES • FORGES • COMBINATION UNITS

Designed and Built for Vocational Education Work by

STEWART

THE BEST INDUSTRIAL FURNACES MADE

(Large illustration shows 4 Stewart Triple-combination furnaces, 12 Stewart Bench Oven furnaces, 1 Stewart double-deck high speed steel pre-heat and high-heat furnace, 2 Stewart semi-muffle oven type furnaces, 3 Stewart direct-fired forge furnaces. Small illustration at right shows 6 Stewart semi-muffle oven furnaces with other Standard Stewart units in background.)

TRAINING MEN FOR THE PRODUCTION FRONT

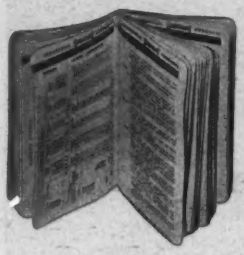
New 75-unit industrial furnace installation at Machine and Metal Trades High School, New York, is typical of the equipment providing basic training needed in war industries.

Because Stewart furnaces have been designed for efficient production heat treating in small shops and tool rooms they are widely recognized as *standard equipment* for all types of industrial heat treating and vocational training work.

Literally thousands of standard Stewart furnaces are in the vocational training departments of technical schools and colleges providing the basic practical training for men needed in war industries. Stewart builds these standard units in addition to the oil or gas-fired heavy duty furnaces, car, pusher or conveyor types; furnaces for plate, shape and angle heating, shell nosing; shell and shot heat treating; rotary hearth furnaces for shell forging.

The 75-unit Stewart installation at the Machine and Metal Trades High School, New York, is one of the newest and largest of its kind in the United States. There are furnaces for carbon-steel, high speed steel, cyanide, lead hardening and tempering, forging and bending, brazing, metal melting, tool room and general production heat treating, as well as experimental work of all kinds.

STEWART SPECIAL SERVICES



VEST-POCKET Heat Treating DATA BOOK

Sixty-eight pages of tables, diagrams and factual data on latest N.E. steel specifications, characteristics and applications. Also much additional information, including the Stewart Conversion and Heat Range Chart. Handy vest-pocket size. Free on request.

For School, Lab and Small Shop

HANDBOOK

A 30-page handbook of elementary heat treating information. Helpful to apprentices, students, schools. Free on request.

WALL CHART

Large 21" x 33" Wall Chart gives latest N. E. Steel Specifications, latest S.A.E. Steels and Heat Treatments, and Supplementary A.I.S.I. Steels. Also Typical Heat Treatments for both Carburizing and Heat Treating grades. Heat Treating Practices for Common Tool and Die Steels, Conversion and Heat Range Thermometer Chart, Hardness Comparison Table. Free on request. (Should you want a chart framed under glass to keep it permanently clean —send $3.00 to cover actual cost of framing. We pay the delivery costs.)

"METAL MINUTES"

Monthly bulletin of notes, comments, news of metal processing, with a guide to articles of special interest to look for in the coming issues of technical publications.

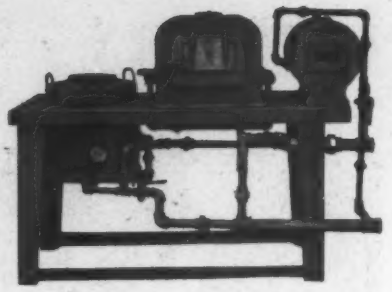
•

A request on your school letterhead will bring you any of these Stewart Special Services without cost or obligation.

STEWART TRIPLE COMBINATION FURNACES

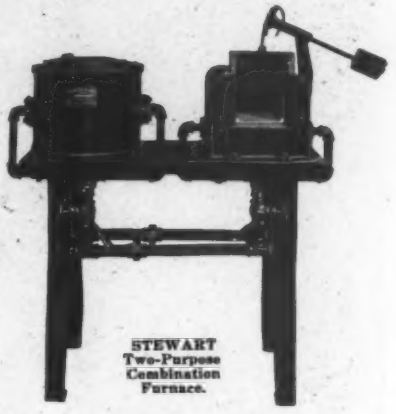
A convenient assembly of three standard STEWART units giving a complete, compact plant that covers practically the whole range of small-scale heat-treatment of metals. The units may be operated singly or all at one time. Various combinations are available.

STEWART Triple-Purpose Furnaces were designed to meet the special needs of educational work in the industrial field. That they serve this purpose best is shown by the large number in regular service throughout the country.



STEWART DUAL COMBINATION FURNACES

Many instructors find two of the STEWART special school units ideal for their course of instruction. To take care of their requirements, we supply various dual combinations of STEWART Ovens, High Speed Steel Furnaces and Pot Furnaces. A unit exactly suited to your needs is readily available. If not listed here, please write without cost or obligation for further details and our engineers' recommendations. (Illustration at the right shows one of the popular Stewart Two-Purpose Combination Furnaces.)



STEWART Two-Purpose Combination Furnace.

STEWART OVEN FURNACES

The complete STEWART Line of Oven Furnaces includes all types, from the No. 51 Bench Oven with a hearth area 5" x 6", to Car Type, Conveyor and Plate Heating Units with a hearth area 15' x 30'. STEWART is perfectly equipped to serve you promptly on any requirements along this line. Write for recommendations and prices. Our engineers are at your service without cost or obligation on your part. (Illustration at right shows one of the popular Stewart No. 51 Bench Ovens.)

STEWART ROUND POT FURNACES

STEWART gas-fired Pot Furnaces are available in all sizes from 6" x 6" to 24" x 24". All have the STEWART feature of burners placed high in the furnace for maximum efficiency and firing tangentially for greatest pot life. Write for further details, outlining your requirements.

STEWART METAL MELTING FURNACES

STEWART manufactures a complete line of Metal Melting Furnaces, both regular and tilting type, including the small No. 4A Bench Type Unit designed to take a No. 4 Graphite Crucible. Write for prices and details.

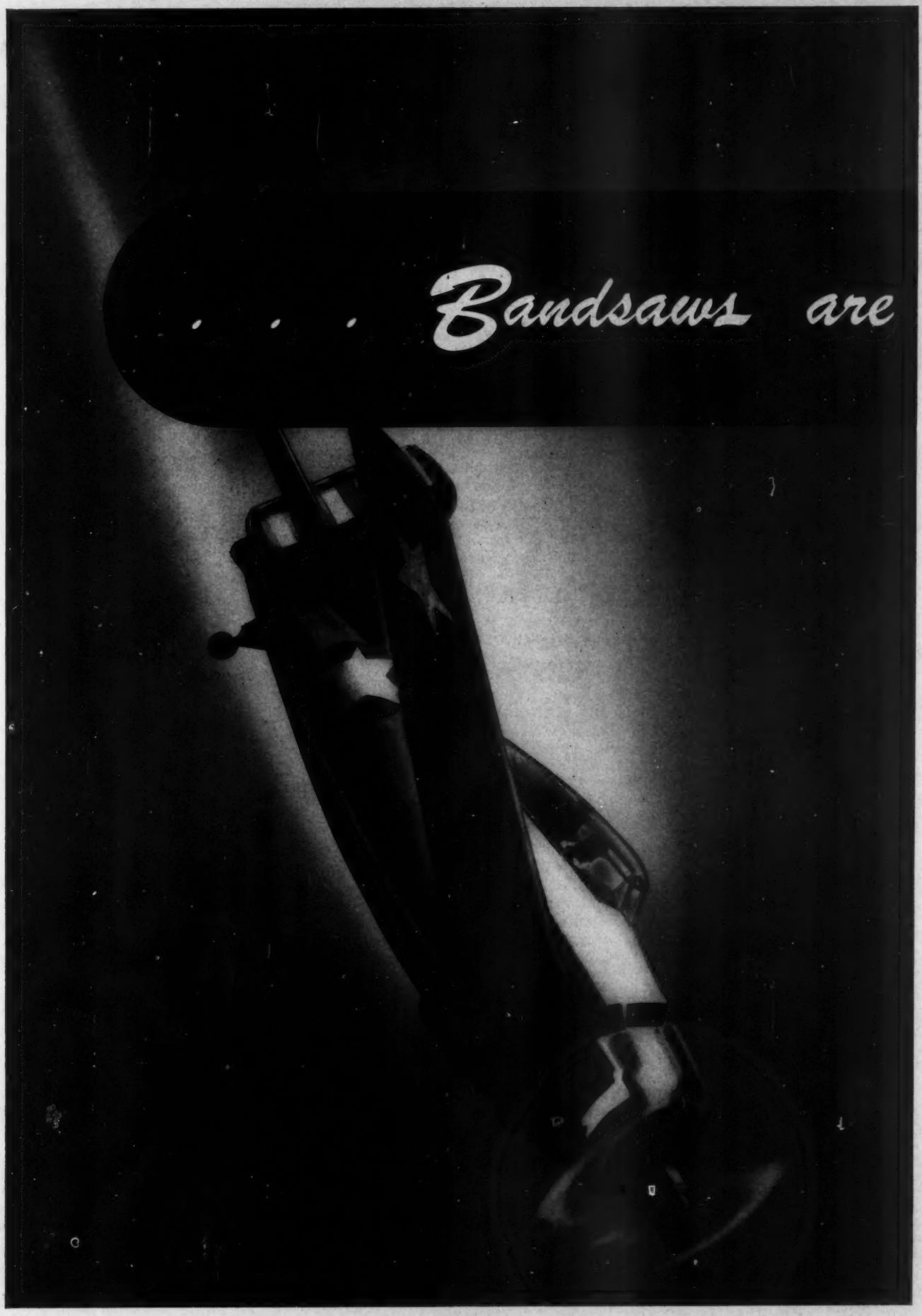
STEWART FORGES

A number of Stewart Forge Furnaces, from small units used for tool dressing and shaping, rod end heating, welding, up to the large units for production drop and steam hammer forging are also popular Stewart units. Write for further details.

A 'phone call, wire or letter will promptly bring you information on Stewart Furnaces designed and built for Vocational Education Work. Or, if you prefer, a Stewart engineer will be glad to call and discuss your needs with you.

STEWART INDUSTRIAL FURNACE DIVISION of CHICAGO FLEXIBLE SHAFT COMPANY

Dept. 114, 5600 W. Roosevelt Rd., Chicago, Ill. • *Over Half a Century Making Quality Furnaces*


. . . . Bandsaws are

Bombing Berlin!

Just as vital as its air field base to each bomber is the field maintenance shop at that base....

There, among the equipment commandos, you will find bandsaws — yes proudly bearing the name Crescent — volunteers for any tough, urgent maintenance job that means *Keep Them Bombing.*

Again, on the home front, where every production hour is a step toward *Victory,* you will find dependable Crescent bandsaws steadily meeting schedules wherever wood is used.

Military orders are not new to Crescent bandsaws. They have been built thru wars and peace for *Fifty* years. Wherever the line of duty, even bombing Berlin, they have what it takes like any other Soldier.

The foregoing explains our temporary inability to maintain a normal flow of Crescent equipment to the schools of America. As rapidly as conditions permit we again hope to serve you.

BUY WAR BONDS AND STAMPS

THE
CRESCENT MACHINE COMPANY
LEETONIA, OHIO

Write today for bulletin describing other dependable CRESCENT machines for woodworking.

Recent McGraw-Hill Texts For War Industries Training

Aviation Trades

Elzea — Aircraft Welding (1942) $2.00
Frazer and Berthiaume — Practical Aircraft Sheetmetal work (1942) $3.00
Nisita — Aircraft Riveting (1942) $2.50
Norcross — Aircraft Blueprints and How to Read Them (1942) $1.75
Norcross and Quinn — How to Do Aircraft Sheetmetal Work (1942) $2.20
Norcross and Quinn — The Aviation Mechanic (1941) $3.00
Wissman — Aircraft Inspection (1942) $2.50

Automotive Mechanics

Crouse — Automotive Electrical Equipment (1942) $2.00

Drawing and Blueprint Reading

Dwight — Reading Blueprints in the Machine Industries (1943) In press
French and Svensen — Mechanical Drawing (1940) $1.60
Russ — Quiz Questions to Accompany French's Engineering Drawing (1943) 25c
Weir — Blueprint Reading (1941) $1.25

Electricity

Perry and Schafebook — Fundamental Jobs in Electricity (1943) $2.20
Schuhler — Electric Wiring, 4th ed. (1943) $2.50
Slack — Elementary Electricity, Rev. Ed. (1943) $2.00
Smith — Elementary Applied Electricity, 3rd ed. (1943) $2.00

Foremanship and Personnel Management

Heyel — The Foreman's Handbook (1943) $3.00
Kress — Foremanship Fundamentals (1942) $2.50

Industrial Teacher Training

Aiken and Lilly — Teacher Training for Industry (1942) $1.25
Hill and Ewing — Methods and Materials for Vocational Training (1942) $2.00
Schaefer — Job Instruction (1943) $2.50

Machine and Metal Trades

Ford Trade School — Shop Theory, Rev. (1942) $1.25
Hall — Practical Wood Patternmaking (1943) In press
McCaslin — Wood Patternmaking, 3rd ed. (1941) $2.25
Whittington — Industrial Inspection and Assembly (1943) $1.75

Radio

Almstead and Tuthill — Radio Materiel Guide (1943) In press
Hicks — Radio Servicing, 2nd ed. (1943) In press
Watson, Welch and Eby — Understanding Radio (1940) $2.80

Related Mathematics

Axelrod — Machine Shop Mathematics (1942) $2.50
Cooke — Mathematics for Electricians and Radiomen (1942) $4.00
Kuehn — Mathematics for Electricians, 2nd ed. (1941) $1.75
Naidich — Mathematics for the Aviation Trades (1942) $1.80
Van Leuven — General Trade Mathematics (1942) $2.50
Weir — Elementary Mathematics for the Machine Trades (1943) In press
Wolfe, Mueller and Mullikin — Simplified Industrial Mathematics (1942) $2.00

Related Science

Frier — Elementary Metallurgy (1942) $1.75
Smith — Applied Mechanics and Heat (1943) $2.00

Sheetmetal Work

O'Rourke — Sheetmetal Pattern Drafting (1942) $2.00

Shipbuilding

Niederhoff — Blueprint Reading for the Shipbuilding Trades (1943) In press

Shopwork

Jones and Axelrod — Introductory Shopwork (1943) In press

McGRAW-HILL BOOK CO., Inc.
330 W. 42nd Street, New York

Use this coupon to
SEND FOR COPIES ON APPROVAL
and other informative literature

McGraw-Hill Book Co., Inc., School Dept. IAVE
330 West 42nd Street, New York

Please send me the following books on approval:

_____

_____

_____

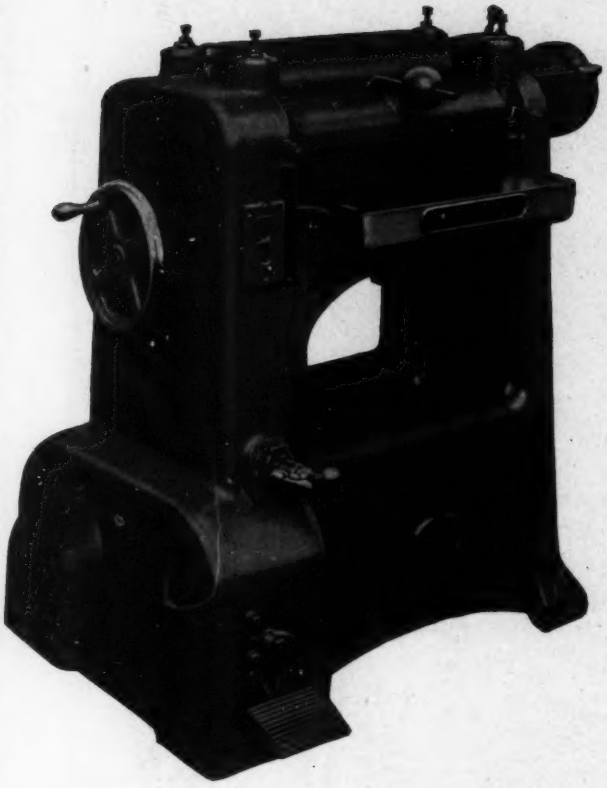
☐ Also the new descriptive booklet "McGraw-Hill Books for the Victory Program."

Name .....
Position .....
School .....
Address .....

Detroit Public Library

LUFKIN TAPES • RULES • PRECISION TOOLS
The way a young man first learns to do things is usually the way he always does them. So it's mighty important that students use the kind of tools that go hand in hand with superior workmanship. More than fifty years experience and a record of constant leadership mean you'll always be right when you use Lufkin Tools.
THE LUFKIN RULE COMPANY
SAGINAW, MICHIGAN
New York City

After the War .



he machine illustrated above is our Model J-18 Surfacer.

ecause of the wide range of machines which we build, we can meet the eeds of all school shops, from the most modest shop in the small com- unity to the most elaborate shops in the larger centers of population. or ready identification the machines are grouped into three lines, as llows:

/-Line—Our lightest machines, designed especially for shops where a w dollars must go a long way.

-Line—Our medium size machines. Precision built counterparts of ur heavy industrial machines.

eavy Line—Our regular, heavier type industrial machines which have ndered outstanding service since 1883.

ATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

Schools, no less than industries, must plan now for the peace that is to come. Just when that time will come no one knows—but all must be ready for it.

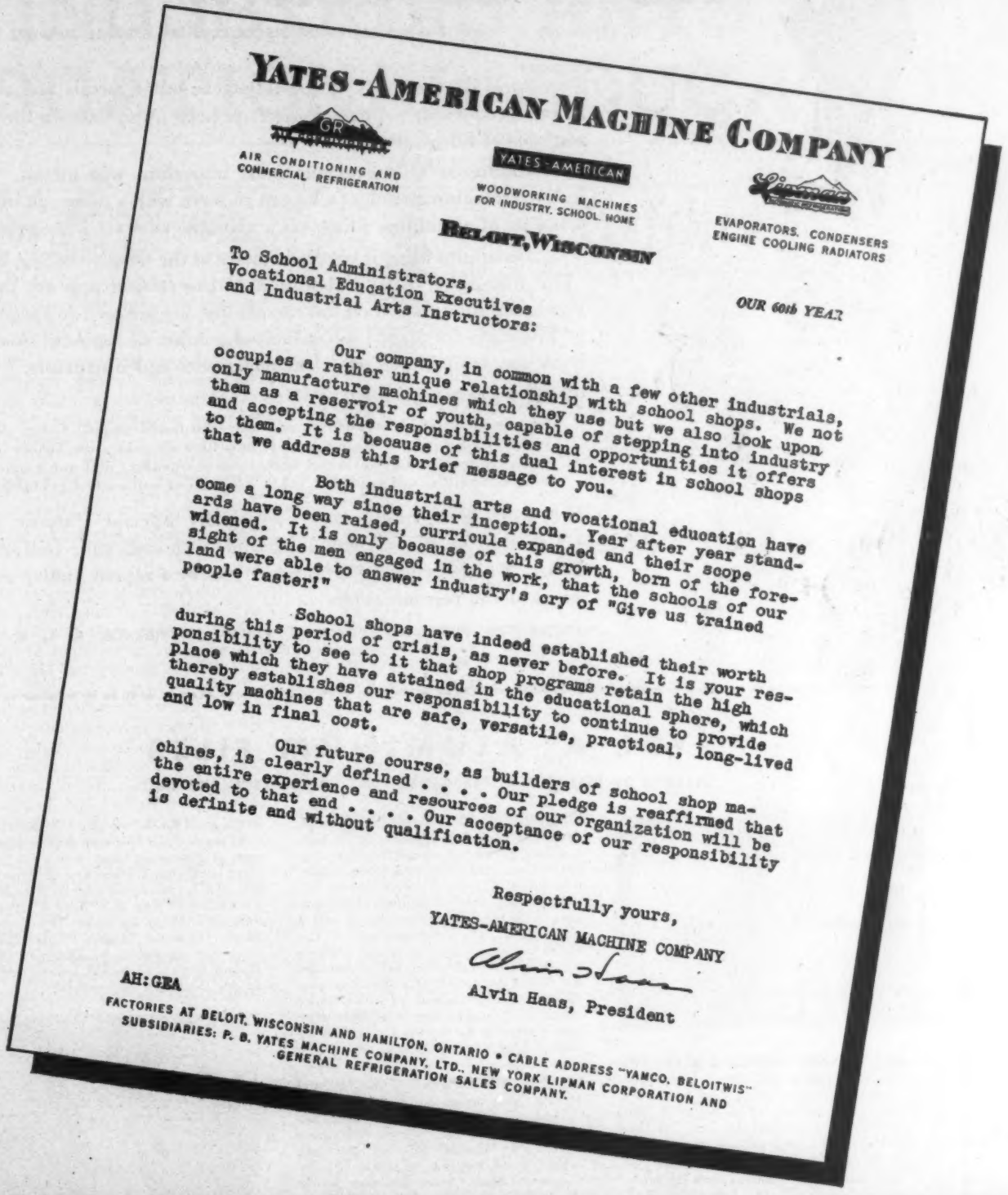
For more than a year, Yates-American woodworking machines have not been available to schools generally. Not because we would have it so — but because the demands of total mechanized war have dictated that our machines must first go directly into the war effort. Their big job now is with the armed forces of our country and in war production, in the ship yards and airplane factories, and in thousands of other plants which are building America's weapons.

In those school shops fortunate enough to have installed Yates-American machines before the present emergency, they have rendered splendid service in vitally important training programs which are helping to fill the manpower needs of war industries. There, patriotic instructors are not only producing trained workers, able to step into wartime jobs in a minimum of time — but are also helping our over-all effort by making their present machines last for the duration. They, perhaps more than anyone else, know what a significant part these machines are playing in the program for victory.

Nevertheless, because most school shops are serving both day and night classes, twelve months a year in greatly expanded training programs, they are taking terrific punishment and are wearing out at a greatly accelerated rate. Hence, many will have to be replaced as soon as peace comes — and it is not too early to start planning now. Wise shop men will want their shops equipped with *Yates-American precision-built woodworking machines* with built-in industrial-type features which, during these war times, have demonstrated again, as they have before, that there is no substitute for quality.

YATES-AMERICAN

. . . . WHAT?



YATES-AMERICAN MACHINE COMPANY

AIR CONDITIONING AND COMMERCIAL REFRIGERATION

YATES-AMERICAN
WOODWORKING MACHINES FOR INDUSTRY, SCHOOL, HOME

EVAPORATORS, CONDENSERS ENGINE COOLING RADIATORS

BELOIT, WISCONSIN

To School Administrators,
Vocational Education Executives
and Industrial Arts Instructors:

OUR 60th YEAR

Our company, in common with a few other industrials, occupies a rather unique relationship with school shops. We not only manufacture machines which they use but we also look upon them as a reservoir of youth, capable of stepping into industry and accepting the responsibilities and opportunities it offers to them. It is because of this dual interest in school shops that we address this brief message to you.

Both industrial arts and vocational education have come a long way since their inception. Year after year standards have been raised, curricula expanded and their scope widened. It is only because of this growth, born of the foresight of the men engaged in the work, that the schools of our land were able to answer industry's cry of "Give us trained people faster!"

School shops have indeed established their worth during this period of crisis, as never before. It is your responsibility to see to it that shop programs retain the high place which they have attained in the educational sphere, which thereby establishes our responsibility to continue to provide quality machines that are safe, versatile, practical, long-lived and low in final cost.

Our future course, as builders of school shop machines, is clearly defined . . . . Our pledge is reaffirmed that the entire experience and resources of our organization will be devoted to that end . . . . Our acceptance of our responsibility is definite and without qualification.

Respectfully yours,
YATES-AMERICAN MACHINE COMPANY
Alvin Haas
Alvin Haas, President

AH:GEA

FACTORIES AT BELOIT, WISCONSIN AND HAMILTON, ONTARIO • CABLE ADDRESS "YAMCO, BELOITWIS"
SUBSIDIARIES: P. B. YATES MACHINE COMPANY, LTD., NEW YORK LIPMAN CORPORATION AND GENERAL REFRIGERATION SALES COMPANY.

YATES-AMERICAN

"Next Lesson..."

NO. 2 OF A SERIES OF DISCOURSES ON SPECIAL PURPOSE FILES

THE rapid development of special steels, other metals and alloys in war production requires workers to keep up to date on the best methods of fabrication.

Aluminum is one of the most important war metals. The industrial training student who can go forth with a thorough understanding of aluminum filing has a valuable advance-training asset.

Aluminum filing is covered briefly in the new Nicholson book, "File Filosophy." An elaboration of the subject appears below. For broad information on the *correct use, proper care* and *selection* of *The right file for the job,* a limited number of copies of this new book are available to school managements and instructors.

"FILE FILOSOPHY"

contains forty-eight instructive, profusely illustrated pages. Covers all widely used regular and special files; how files are made; the history of files; file terminology; saw and implement sharpening; and much other information that will prove helpful in turning out well-trained graduates.

For your file requirements — especially Special Purpose Files (Nicholson or Black Diamond brand)—consult your mill-supply house. Good hardware stores usually carry a representative assortment of the regular kinds.

NICHOLSON FILE CO., 47 ACORN STREET, PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

"TYPE A" ALUMINUM FILES

Prepared by RESEARCH DEPARTMENT • NICHOLSON FILE CO.

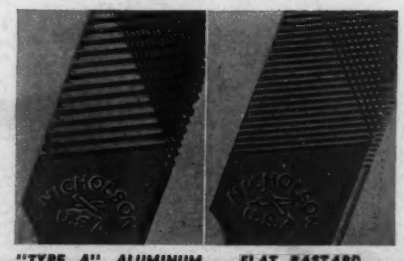
WHY ALUMINUM REQUIRES A SPECIAL FILE. Aluminum is a soft, ductile, malleable metal, and any cutting tool has a tendency to build up chips before it. This is likely to dull the tool.

The difficulty in filing soft aluminum with an ordinary file is that the teeth are soon clogged unless very light pressure is used.

CONSTRUCTION OF THE ALUMINUM FILE. After study of aluminum filing, Nicholson has produced the Nicholson (or Black Diamond) "Type A" Aluminum File which is specially designed for filing aluminum and aluminum alloy castings. This file has a deep upcut and a fine overcut. The latter produces on the upcut a succession of small scallops which break up the filings. This enables the file to clear itself of chips. The open throat construction also tends to prevent clogging of the file. The light overcut reduces chatter by preventing the teeth from taking too large bites.

USE OF THE ALUMINUM FILE. While designed to cut aluminum rapidly, "Type A" Aluminum Files leave a somewhat better finish than the coarser aluminum files. They should be used on work where quick removal of metal is more important than finish. However, by filing with a shearing stroke toward the left, a good finish can easily be obtained.

In some cases—as with harder aluminum or aluminum alloy castings—regular Flat Bastard Files are satisfactory. But if it is found that regular files have a tendency to clog, the "Type A" Aluminum File should be used. Nicholson or Black Diamond "Type A" Aluminum Files are available in Flat and Half Round shapes, 6" to 16" length and all in one degree of coarseness.



"TYPE A" ALUMINUM *FLAT BASTARD*

NICHOLSON FILES *FOR EVERY PURPOSE*

NICHOLSON U.S.A. MADE IN U. S. A.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 32 MARCH, 1943 Number 3

THE 1943 SCHOOL SHOP ANNUAL

Again the School Shop Annual presents material to its readers which emphasizes Wartime Service in a special way.

War-production training has placed a heavy burden on vocational education, but the schools have willingly assumed, and are carefully planning and efficiently carrying out, this extra work that has been entrusted to them.

Industrial arts, too, has sought to do its part, and this issue of the Annual shows what some of the larger cities are doing in the way of introducing preinduction, pretraining, preaeronautics, and preflight courses.

While wartime production training naturally holds the forefront of the educational stage, it must not be forgotten that industrial arts plays an equally important part in conditioning youth for the tasks which will be assigned to it in the near future.

If, as General Somervell claims, 63 out of every 100 inductees must have or must acquire specialized knowledge and skills, it is quite logical to start preparing youth, even in the junior high school grades, for the inevitable service which every able-bodied American must render just as soon as he attains the age of 18.

The training of women and girls is becoming increasingly more important, because the War Manpower Commission has predicted that the number of women war workers will have to be increased by approximately 5,000,000 by the end of 1943.

This, too, challenges both the vocational and the industrial teacher, and this Annual brings to its readers a description of the work which some of their co-workers have inaugurated already.

THIS MONTH'S COVER

The picture chosen for the cover of the 1943 School Shop Annual presents a scene common in preinduction as well as in wartime production training.

The photograph was taken at the School of Vocational and Adult Training, Racine, Wis.

CONTENTS

War Production and Preinduction Training

Detroit Public Schools in the War Effort, *Earl L. Bedell* and *Walter E. Gleason* 85
Industrial-Arts Education in the War Effort, *Louis V. Newkirk* 89
The Impact of Hitler et al. Upon Philadelphia High Schools, *A. O. Michener* 91
The War Program of Industrial Arts in the Minneapolis Public Schools, *Clifford K. Lush* .. 92
Preinduction, Preaeronautics, and Pretraining, *R. A. Radtke* 96
War and the Industrial-Education Program, *G. H. Silvius* 97
Relation of Industrial Arts to the War Industries, *R. H. Roberts* 101
Responsibility of Industrial Arts in the Present Crisis, *W. C. Giese* 104
Preflight Training, *Harry R. Wilson* 106
Women in the School Shops, *H. J. Shufelt* 110
A Technique for the War-Production Training Program, *S. Joe Williams* 111
Drafting for Girls, *Louis Barocci* 114

School Shops

A War-Training Machine Shop, *G. H. Parkes* 115
The Owensboro Technical High School, *E. C. Landberg* 117
Layout and Equipment for a Vocational Radio Shop, *Joseph Murri* 120
Community Repair Shop, *Louis M. Roehl* 123
Storing Woodworking Project Material, *G. Lester Steinhoff* 125

Course Outlines

Air Navigation Course, *Hugh J. Betts* and *Charles A. Browning* 127
Course of Study for Farm Shop, *Elvin J. Bomaster* 128
Integrating the Related-Subject Teaching in the Vocational School, *Andrew J. Miller* 131

Miscellaneous

The Winning Way, *Leonard E. Schmidt* 114
Check List of Personnel Duties, *Sam Hitchcock* 133
Report Sheet for War-Production Training Classes, *R. J. King* 134
A Student-Kept Time Card, *William Becker* 135
School-Shop Safety, *H. W. Schmidt* 135
Camouflage Course, *Richard E. Bailey* 136
Creative Design, *Richard E. Bailey* 138
Design for the Teacher of Industrial Arts, *Burl N. Osburn* 139
Whittling-Jackknife Technique, *W. Ben. Hunt* 141
Teaching Materials for Industrial Education, *Chris H. Groneman* 58A
Controlling Production So As Not to Interfere With Instruction, *George W. McCarty*, and *William C. Ash* 66A
Progress Records for the Automobile Shop, *Lester Brown* and *D. L. Downing* 78A
The Worker, *Leonard E. Schmidt* 84A

Equipment and Supply List

Metalworking 26A
Automotive 36A
Electricity 40A
Woodworking 50A
Printshop 74A
Drafting 76A
Personal News 25A
Association News 33A
Questions and Answers 47A
News Notes 57A
Shop Equipment News 68A
New Publications 93A

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

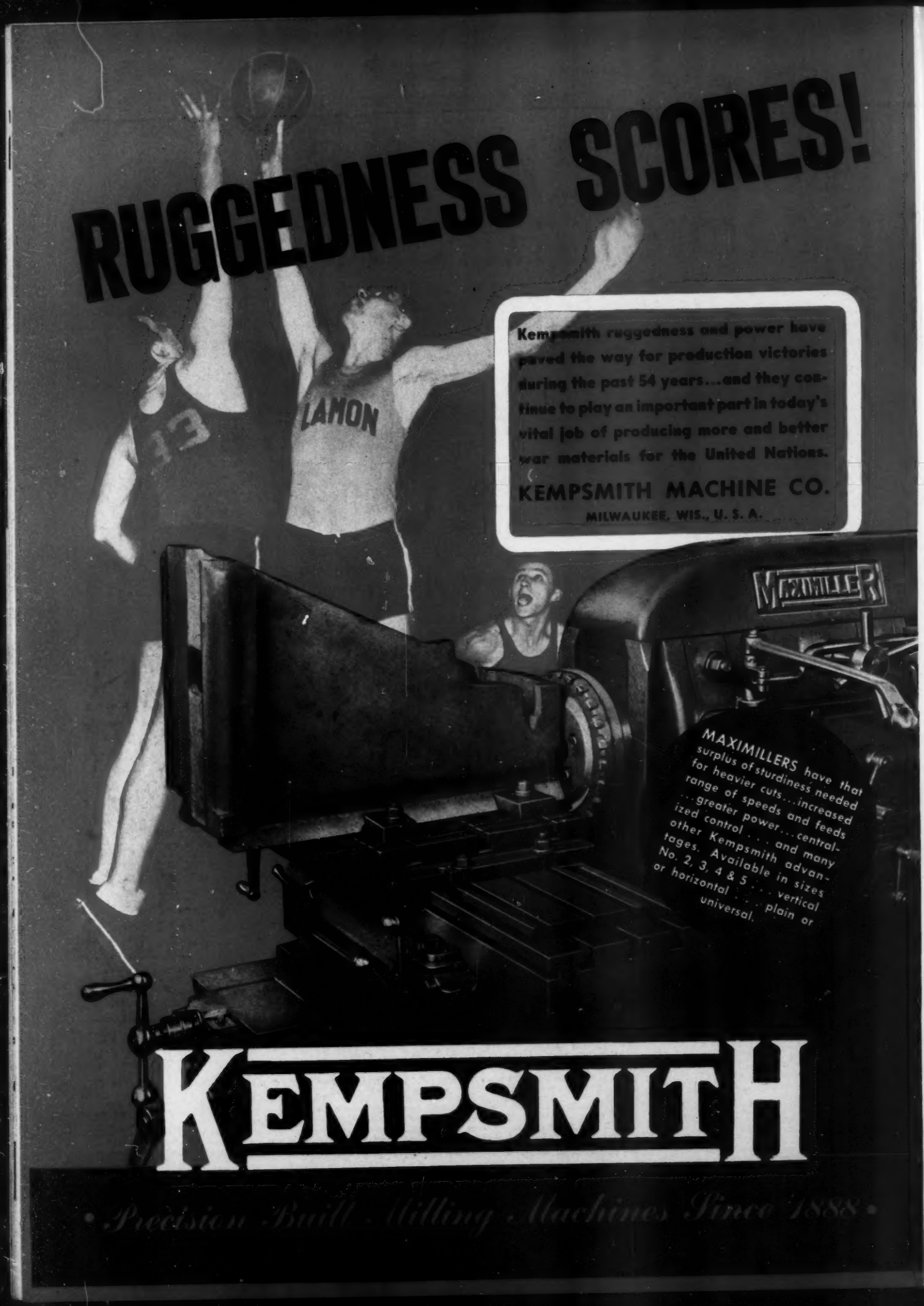
Entered January 2, 1914, as Second-Class Mail Matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright 1942, by The Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, November 25, 1930. Published monthly except during July and August.

Subscription Information. — Subscription price, $2.50 per year, payable in advance. Canadian postage, 50 cents; Foreign Countries, 50 cents. Copies not over three months old, 35 cents; more than three months, 50 cents. Notice for discontinuance of subscriptions must reach Publication Office in Milwaukee at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

PUBLISHED MONTHLY, EXCEPT DURING JULY AND AUGUST, BY THE BRUCE PUBLISHING COMPANY, 540 N. MILWAUKEE STREET, MILWAUKEE, WISCONSIN

Eastern Office: 330 W. 42nd. St., New York, N. Y. — Western Office: 66 E. South Water St., Chicago, Ill.


RUGGEDNESS SCORES!
LAMON
Kempsmith ruggedness and power have paved the way for production victories during the past 54 years...and they continue to play an important part in today's vital job of producing more and better war materials for the United Nations.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
MAXIMILLERS have that surplus of sturdiness needed for heavier cuts...increased range of speeds and feeds ...greater power...centralized control . . . and many other Kempsmith advantages. Available in sizes No. 2, 3, 4 & 5 . . . vertical or horizontal . . . plain or universal.
KEMPSMITH
• Precision Built Milling Machines Since 1888 •

WAR PRODUCTION *and* PREINDUCTION TRAINING

Detroit Public Schools in the War Effort

EARL L. BEDELL*
WALTER E. GLEASON**

Organized education is accepting responsibility for a great many functions in the national war effort. Regarded as an indispensable war instrument, the school has been turned to for a greater variety of services than at any previous period in American history. Democracy always has challenged educators to develop schools that will serve efficiently the needs of the community and the present national emergency has impressed upon them a new sense of responsibility for fulfilling a particular job.

Today, education does not stand in isolation from society. It is not included in the category of "nonessential" enterprises which absorb a large part of our social and economic resources without regard to national benefit. Quite the opposite, public education involves a program of service which the people eagerly support and finance. This element of school-community cooperation, originally embodied only in the great philosophies, has become pretty well established in all educational functions. And certainly this global war, tremendously accelerative in its social influence, has greatly stimulated extensive development in the direction of community participation.

Vocational educators should pay careful attention to this unprecedented participation of the school in national life and not regard the foregoing remarks as dogmatic rationalization to cast an aura over contemporary public education. As a matter of fact, the doctrine of service to community needs has experienced general acceptance and wide application in the field of vocational education for a quarter of a century and more. If the functional philosophy of education has been, during this period, a part of the vocational educator's consciousness, its criteria are even more evident in his patterns of school organization and classroom practice.

For example, the educational critiques of the future will undoubtedly trace the theoretical foundation of preinduction training program installed this year in the secondary schools to the functional concept of learning. Preinduction training epitomizes this teaching of purposeful education, signally. The essence of preinduction training is that American youth of age 18 must begin to serve either in the armed forces or in war-production industry. It is terminal in nature; that is, it points the student directly toward some specific job in one of the two fields of service indicated. Without jeopardizing the values of general education, the current redirection of the public school program is designed to assist the war effort immediately and in specific ways.

In providing training for war-production or military service, the public schools have

Machine tool operation at Cass Technical High School

*Director, Technical and Vocational Schools, Detroit, Mich.
**Staff Member, Information Service, Detroit, Mich.

become vast public service centers, integrated with the war economy and operating to develop full utilization of the nation's man-power resources. With respect to war production, education, in particular vocational education, is responsible for training workers on all levels of industrial performance; the single-skill pay-roll job level, the craft level, and the technical level ranging from the upper reaches of skilled trade operation to professional and administrative or managerial service. Stating the situation in another form, this discussion stresses that training must be available to production operators; skilled production specialists; all-round skilled mechanics; engineers, chemists, and physicists; and plant managers and supervisors of personnel, in both the employed and unemployed categories.

With respect to service in the armed forces, the whole objective of preinduction training is to meet occupational shortages by reducing to a minimum the amount of training necessary after induction in the military services. By performing this job, vocational education can release the resources of the Army and Navy to the combat application of the technical preparation provided in the preinduction courses.

Whether preinduction courses are directed toward war-production work or military service, the training program of the public schools must be built according to the specifications outlined by industry and the armed forces in cooperation with the War Manpower Commission. Moreover, while occupational training needs for the military are generally uniform and can be organized on a national basis, for war industry, it is local in nature and therefore must be developed in terms of community need through the use of community facilities. Every school system has to analyze the local war-production requirements and work out instructional procedures that will correlate training courses with the actual job operations in every occupational area faced with critical labor shortages.

A vocational training program of this nature is a far cry from the days of sloyd which defined learning in the vague terminology of "useful objects," which seem to regard any concretion as a criterion of practical instruction. Today all high school courses throughout the country, especially those in the eleventh and twelfth grades, must demonstrate their validity in terms of military preinduction value, pre-employment preparation for employment in the war industries, or civilian war service.

It should be noted, however, that while vocational education is alert to the necessity for training single-skill operators for service in war-production industries, it is deeply concerned that the broad concepts basic to American citizenship which the public school has fostered shall be protected against the hazards of war. An educational program built around job training only is not enough, for vocational competency is only one among many of the social functions of the public school.

The construction of the scale model aircraft was organized on a production basis, patterned after the assembly line technique of the automobile industry

The Schools and the War in Detroit

War Work Training Among High School Youth

In Detroit, the regular courses offered in the technical and vocational schools required little modification to serve the specialized functions of men serving in industry and the armed forces. The reorganized secondary school program includes an extension of the adult vocational training for war-production workers to high school youth, both boys and girls, age 17 years and 9 months, with prospects of the age limit being lowered to 16 years. Training is organized in units of 15 hours per week and is accredited toward graduation. The high school administration has liberalized its credit policy permitting students thereby to substitute pre-employment preparation for certain other courses essential to graduation. The training offered to the youth is identical with that provided adults. A student may enroll in a course conducted at some training center other than his school and in the evening if conditions justify this action.

Preinduction Training for Military Service

In order to meet the objectives of the Victory Corps Program, the basic curriculums of the Detroit high schools have been completely reorganized to assist the armed forces to supply their needs for specialized personnel. The programs of study for grades XI and XII have been organized into 7 major divisions and 11 courses have been added. The divisions are: air service, Army or land service, sea service, professional service, industrial service, commercial service, and homemaking service.

The first three bear directly upon preinduction needs: the air service curriculum is designed for those students who plan to become aviation cadets and includes those training to be flying officers, i.e., pilots, bombardiers, gunners, or navigators and ground officers in armament, communications, engineering, meteorology, photography, and aircraft repair and maintenance. The Army or land service curriculum is intended as preliminary preparation for service in some branch of the ground forces of the Army. The sea service curriculums provide preliminary preparation for service in some branch of the Navy or Merchant Marine (other than naval aviation). The professional service curriculum offers preliminary training for work in such professions as: engineering, social work, medicine, nursing, dentistry, teaching, librarianship, and dietitian. The industrial service curriculum serves those students who plan to enter employment in war industries. The commercial service curriculum is intended as preliminary preparation for the stenographer, typist, bookkeeper,

Built to the specification of the U. S. Navy, each plane was inspected for accuracy of construction

salesman, or other distributive or commercial service. The homemaking service curriculum furnishes preliminary preparation for homemaking, child care, home nursing, nutrition, or similar services.

The 11 courses added to the program are: fundamentals of machines, fundamentals of electricity, fundamentals of radio, fundamentals of shop, radio maintenance and repair, one year of mathematics, refresher courses in mathematics, preflight aeronautics, code practice and touch typing, contemporary affairs, and automotive mechanics.

The preflight aeronautics course was among the first of the preinduction courses to be developed in Detroit. The supervision of this training was assigned to the Vocational Education Department which promptly appointed a full-time supervisor to develop instruction to the highest possible degree of efficiency.

The preflight aeronautics training course is offered in the twelfth grade, covers one year of preflight training and provides ten hours of credit. The objective of this course is to prepare boys for flight officer occupations in the Army and Navy Air Corps. It offers no ground crew work, but concentrates on shortening the time required by the Army and Navy for preliminary flight training and on reducing to a minimum the number of failures among Air Corps candidates. The course provides students with the ability to perform quickly and with exactness the fundamental operations in mathematics, gives them a working knowledge of physics, and a thorough understanding of the principles of flight.

Physical Fitness

In order to furnish the reader with a complete picture of Detroit's program, a brief discussion of the physical fitness program seems appropriate.

For the past 25 years the health education program has emphasized broad social concepts basic to living in a democracy. At the same time considerable emphasis was given to the elimination of communicable diseases and the correction of physical defects. While continuing this program, the emphasis is now upon the correction of those physical defects which may prevent military service, and upon improvement in bodily vigor.

Both boys and girls in our secondary schools are being conditioned to the rigors of war. Boys are being toughened to the hazards of military service and are being equipped with the physical skills involved in various military operations. In swimming, for example, boys will be taught to blow oil away from the surface of the water and submerge for concealment from the enemy. A limited amount of commando type of training will be given to toughen muscles and endow bodies with endurance against all sorts of strenuous physical conditions.

Co-ordinating School Community War Services

The expansion of the educational program to provide mass-production training, however, is comparable to the overflow, at flood tide, of a large river from its normal channels. Since the type of service rendered was *still* training, no different channels of service developed. But with the emergence of the all-out war effort following the historic Pearl Harbor attack, demands were made upon the schools for assistance in carrying on important community war services. New channels of service rapidly came into existence on the educational terrain although considerable community participation has, of course, obtained in Detroit schools for the past 25 years. Since new critical community needs became apparent, many civic-minded citizens and community organizations promptly came forth to provide the necessary leadership for the organized effort that resulted in city-wide campaigns and projects of one sort or another. Naturally these war pressures for public action soon centered in the schools who were called upon to participate in programs which fall definitely in the category of community service. These demands on the schools for cooperation in community war services came with such rapidity that both school officials and the public became somewhat mentally confused and troubled. It soon became manifest that efficient cooperation would require some administrative mechanism to co-ordinate these efforts and the various group relationships involved. In consequence, in the fateful month of December, 1941, a co-ordinating committee of key persons representing different divisions of the Detroit school system was established and put into operation. The responsibilities assigned to this committee are:

1. Reviewing all requests, from sources outside the schools, to have the school engage in particular activities related to the war effort.
2. Taking steps to insure that proposals approved are carried out in all schools.
3. Taking steps to insure that war-related activities in the schools are executed with the greatest possible efficiency, and with a minimum of waste and duplication.
4. Providing for a flow of information regarding defense activities from the central office to the schools and from the schools to the central office.
5. Reporting and interpreting to the community the way in which the Detroit public school system is cooperating in the war emergency.

The committee has been serving for a year and has performed a splendid job in carrying out its appointed functions. It has initiated research studies into the best methods of protection of school personnel and property. It has kept the school informed of the results of these studies through a series of official releases and bulletins. It has made recommendations to the proper administrative authorities concerning the requests of cooperation with organizations outside the school system. It has discussed the plans of the schools as related to those of the entire community

with the local Office of Civilian Defense. The committee has served as a clearing-house for activities and information concerned with the war effort as related to the public schools.

School authorities through this committee have reorganized the schools to meet two distinct types of wartime responsibilities, namely: (1) to protect the children and the staff from personal injury and to provide aid and comfort to those who may be so unfortunate as to suffer personal injury or great inconvenience at the hands of our enemies; and (2) to provide ample opportunity for pupils and the staff to participate directly in the various organized war efforts.

Accepting responsibility for the protection of children and staff, the Detroit schools have: (1) developed a system of central and intercommunicating air-raid signals and a system of air-raid drills within each school and protection areas within the school; (2) provided an organization which stands ready to utilize the schools as emergency shelter stations with complete plans for feeding and bedding and giving first aid.

In order to provide an opportunity for both pupils and staff to participate in productive work in the war effort, there has been elaborate and detailed planning. Among the first ventures into large-scale participation was the Vocational Training for War Production Workers. This program in our schools needs no further explanation among vocational educators.

The American Red Cross has been actively working with the Detroit schools for many years. The first-aid course supervised by them has been given to high school graduates for a long time. The Red Cross has always given the training courses to our teachers. Naturally the war has accentuated this program.

The Junior Red Cross has had a prominent place in our schools. The Red Cross Toy Project, as it is called, has made possible the distribution of literally thousands of toys to the underprivileged children in Detroit, as well as large quantities to unfortunate children living in devastated areas abroad. This toy project has vitalized the shopwork in the junior high school grades for more than twenty years. The program has been accelerated to meet the war needs. Furthermore, the construction of many other articles currently in great demand is being hastened with all speed. Characteristic of articles needed and in production in all industrial-arts shops are crutches, cots, and stretchers. With the advantage of knowledge gained in research several years ago, the schools are ready to build games suitable for the convalescent patients in our Army and Navy hospitals. Paralleling the work in the shop class was the work done by girls in the homemaking classes. Dresses, undergarments, and sick-room equipment constitute a major part of the serving activities.

A splendid example of direct pupil and teacher participation in the national war effort was the recent construction of large quantities of scale model airplanes for use in training naval personnel in aircraft identification. This was a mass-production project carried out in the shops of the high schools: Fifteen hundred units were produced according to specifications submitted by the United States Navy in cooperation with the United States Office of Education. Since model aircraft activities are frequently associated with the amateur, it should be pointed out that the pupils and teachers had to satisfy high standards of mechanical construction efficiency which in turn depended upon applying the most rigid tests of exactitude to each plane produced. Any error in construction resulted in prompt rejection as unsatisfactory for combat service.

Upon completion of this project, a public exhibit of the planes was given at which the Commandant from the Grosse Ile Naval Training School was present to accept the airplanes officially for the United States Navy.

This article would be incomplete unless at least brief reference were made to the participation of pupils and teachers in national movements associated with the war economy. In all the 319 schools in Detroit, concerted efforts were undertaken in which all the children individually contributed to the conservation of critical war materials, such as rubber, metal, and paper. The pupils in industrial-arts classes have assumed considerable initiative and responsibility for collecting salvage materials usable in the instructional program. A distinctive contribution is the sale and purchase by the pupils of $1,250,000 of War Bonds and Stamps during the past year. It is estimated that by the end of the present school year this figure will be doubled.

Teachers, aided by other board of education employees, have assisted the people to make satisfactory adjustment to these economic shortages imposed by war conditions. Their efficient cooperation with governmental authorities has been an invaluable factor in the successful operation of the different war-rationing programs in the local area. For their generous services they have gained considerable public esteem and general community commendation.

The public display of scale model aircraft culminated a year of work in the school shops

Industrial-Arts Education in the War Effort

LOUIS V. NEWKIRK*

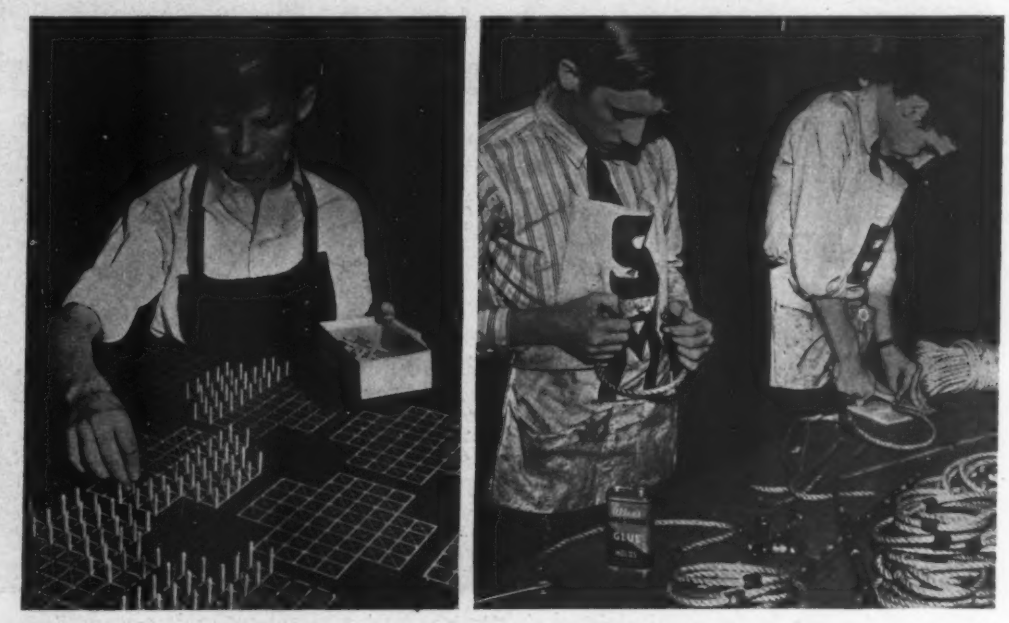
The Chicago Bureau of Industrial Arts has been constantly on the alert to aid in every way possible with the war effort. First of all the Bureau of Industrial Arts has worked to give the boys and girls the best possible instruction in integrated handwork, home-mechanics laboratory, industrial-arts laboratory, and laboratory of arts and industries in order that they may have the background of industrial information and foundational skills essential to intelligent living and future vocational training.

In addition to presenting fundamental industrial-arts instruction the teachers and pupils of the industrial-arts department have been able to make many definite contributions to the war effort. They have made 12,000 games for Yanks; built 20,000 scale model airplanes for the Navy, Army, and civilian defense; designed and built 30,000 items for the Red Cross; given instruction to 100,000 boys and girls on how to take good care of the equipment in their homes so it will last for the duration; made the construction designs and drawings for the National Office of the Red Cross; and give courses in handicraft to the Gray Ladies of Red Cross, so that they may work with convalescent soldiers in the hospitals of the Chicago area.

A brief statement about the different types of war-effort activities of the Bureau of Industrial-Arts Education are given in the following paragraphs. Pictures representative of each type of work are included.

Games for Yanks

The teachers and students in the industrial-arts laboratories have made 12,000 games which were contributed to the Army, Navy, U.S.O., and Red Cross for recrea-



Making peg games and ring-toss games for the U. S. O.

Making legs for emergency stretchers and testing the new stretchers which have been made for the Junior Red Cross

*Director, Bureau of Industrial-Arts Education, Public Schools, Chicago, Ill.

Windows and locks receive careful attention in the home-mechanics laboratory, and needed repairs are made by pupils studying clothing

Repairing electric iron and other electrical home equipment

Checking scale model planes for the U. S. Navy on the left. On the right, James B. McCahey, president, Chicago Board of Education, congratulating Chicago's seventy Captain Aircraftsmen, while Robert B. Upham, city comptroller, and Dr. William H. Johnson, superintendent of schools, look on

tional use. The Bureau of Industrial-Arts Education also prepared a bulletin called, "Games for Yanks," which has been widely used in all states of the union and several foreign countries. Over 7000 copies of the "Games for Yanks" bulletin have been distributed free to those wishing to make games for the armed services.

Scale Model Airplanes

The Bureau of Industrial-Arts Education has directed the U. S. Navy's model airplane project for the Chicago area and has built 20,000 scale model planes for use in training pilots, gunners, and civilian defense spotters. The Chicago schools had 70 captain aircraftsmen.

Junior Red Cross

The Bureau of Industrial Arts has built 6000 lapboards, 4000 writing boards, 5000 tin-can ash trays, 1000 stretchers, 15,000 games, 10 ping-pong tables, 8 book carts, and 100 lamp stands for the Junior Red Cross.

Making Home Equipment Last for the Duration

Over 100,000 boys and girls have had training in the home-mechanics laboratories on how to care for the essential equipment about the home. The home-mechanics laboratories have also built lapboards, writing boards, and tin-can ash trays for the hospitals of the Chicago area.

The Impact of Hitler et al. upon Philadelphia High Schools

A. O. MICHENER*

The Quaker City probably shares its experiences and experiments with all of the metropolitan centers of the nation. War for the nation could be foreseen as inevitable, but our actual assumption of the military role found us woefully unprepared. So our school systems had a premonition that the clash of arms would bring us face to face with urgent problems, but we were loath to accept the candid fact. Any address or article upon present modifications of curriculum very naturally starts with the National Institute on Education and the War, held at Washington, D. C., at the end of August, 1942. This significant gathering brought together the educational leaders of secondary and higher education and the responsible administrative officers of our Federal Government. The program was sponsored by the United States Office of Education War Time Commission. The schools of America were put under the obligation of extraordinary effort for the better preparation of students for the enterprises of war. Dr. John W. Studebaker, United States Commissioner of Education, addressed himself particularly to the high schools with the emphatic admonition that they must convert to the necessities of total war. With the earliest sessions of September our foremost thought was devoted to the specific training of our youth and the preparation to best advantage of those shortly to be inducted into the service.

The message of President Roosevelt to the educators of the United States gathered for the national institute stated these thoughts:

"Our schools, public and private, have always been molds in which we cast the kind of life we wanted. Today, what we all want is *victory*, and beyond victory a world in which free men may fulfill their aspirations. So we turn again to our educators and ask them to help us mold men and women who can fight through to victory. We ask that every schoolhouse become a service center for the home front, and we pray that our young people will learn in the schools and in the colleges the wisdom and forbearance and patience needed by men and women of good will who seek to bring to this earth a lasting peace."

From all sides has come a concerted emphasis on the need for speed, for accuracy, and for efficiency. The combat methods of today need specialized training as never before. The civilian output upon which the success of battle depends is clearly realized. Our schools must be reservoirs of occupational information and capable of guidance into critical services. Physical fitness is essential to the demands of the day. We have found that mathematics and science, as the basic knowledge of technology, must be served to the ultimate degree. English and the social studies are the all-important vehicles to train youth for citizenship in a democracy. Aeronautics and the fundamentals of the preinduction courses are part and parcel of the work that must be done in every school.

During the summer of 1942 a number of our high school teachers, totaling almost 100, undertook government sponsored courses in preflight aernonautics at Temple University. At the same time, classes were opened by invitation to upper classmen of the high schools to take a preaviation course at the Bok Vocational School. The teaching was done by four of our regular instructors who were qualified for this work. Eighty-four boys and ten girls enrolled for this work. In the same school, over 200 pupils were enrolled for this phase of preparation in the day summer school classes, and more than 260 took the work in the evening sessions. During the fall semester, 35 high school teachers chosen from among 90 applicants took a special afternoon course in radio at Temple University in order to be prepared for classroom work in the spring term. This work was underwritten by the board of public education with regard to tuition fees and the like. Another class, voluntary both as to instruction and attendance, was presented to some two score teachers in navigation. The work was given at the William Penn High School through the courtesy of the United States Power Squadrons. Various faculties have been willingly earnest and cooperative in providing refresher work for teachers assuming unaccustomed fields by virtue of the changes in our courses of study.

On the very first school day of September, the principals and heads of departments were gathered for conference by Associate Superintendent Dr. Edwin W. Adams. Plans were at once set in motion to meet the necessities of our situation. The young men to graduate in January, 1943, or those soon draftable because of an eighteenth birthday were the primary concern. For this group, regular rosters were changed to double the amount of time in physical education, to give intensive work in mathematics, to add science for those not so scheduled, and to turn our work in English and social studies to the advantage of these students. The board of education generously provided a special allotment to pay salaries for teachers and to provide materials and equipment for after-school classes in six of our high schools. These groups took the government outlined courses in the fundamentals of electricity, machines, radio, and auto mechanics. Three of our high schools initiated full or partial courses in aeronautics. Approximately 400 young men benefited by these opportunities.

A small steering committee was created to plan for the changes affecting all of the pupils of the secondary schools for the semester starting February, 1943, and con-

*Assistant, Associate Superintendent, Philadelphia, Pa.

tinuing during the state of emergency. Heads of departments were brought together to undertake the technical details of revision. What was done for the graduates of January, 1943, is now carrying over into the entire life of the schools. For such a periodical as INDUSTRIAL ARTS AND VOCATIONAL EDUCATION a predominant interest grounds in the preinduction and war-elective courses. Our vocational schools manifestly cater to industrial needs. In Philadelphia, these schools and the commercial and industrial departments of our senior high schools will reinforce their work in line with the most pressing needs of our wartime situation. As war electives, the following subjects are being offered in our high schools — art war activities, calculating-machine operation, child care and development, clerical practice, code and touch typing, home nursing and red cross sewing, mathematics, mechanical drawing and blueprint reading, modern foreign languages, principals of food and clothing, conservation and nutrition, science (chemistry, physics, or biology), shop, typing-stenography, victory gardens, and war geography-cartography.

Preinduction training following the syllabuses prepared by the Department of War will include elements of aeronautics, fundamentals of auto mechanics, fundamentals of electricity, fundamentals of machines, fundamentals of radio, and fundamentals of shop, with the addition of any course specifically recommended by the office of education, the War and the Navy Departments. Textbooks are pouring from the presses of the publishers to amplify the outlines that have so far been prepared as indicated above.

Undoubtedly, the reader is aware that these preinduction training courses are now in printed form and may be secured from the Superintendent of Documents, Washington, D. C., at a cost of 10 cents a copy.

The requirement has been established that every graduate of a senior high school shall have had one preinduction course in the regular roster, and the taking of two such courses is strongly recommended. Realizing the imminence of the introduction of women into war work, our shops and drawing rooms have been freely opened to those who, in Victorian days, were known as the gentler sex. It may be of interest to note that in the spring semester we have enrolled the following numbers of students:

Aeronautics	425
Fundamentals of electricity	1498
Fundamentals of auto mechanics	362
Fundamentals of machines	3053
Fundamentals of radio	1037
Fundamentals of shopwork	1020

The question of food production is so vital that serious consideration is being given to preparing numbers of high school boys and girls for agricultural work. Last autumn on week ends, scores upon scores of our high school students went to near-by farms. Men whose crops were about to perish in the fields have been laudatory concerning the efforts of our young people who saved food crops. In connection with the agricultural division of the United States Employment Office, brigades will be organized for this essential work during this year. In this immediate area, we already know that an underestimate indicates 3500 workers will be needed for the months of June, July, and August, and 4500 in the month of September. No fact can be set on paper at this moment, but it is strongly hoped that definite instruction may be given to those who will undertake this form of aid to national need.

No attempt can be made within the limits of this article to discuss the fundamentals of preinduction training. We are all working with explicit recognition that idealism and aesthetics play an indispensable part in human existence, but that in a period when war lords seek to dominate the world the contest of battle must find foundation in physical readiness. Those who go from our high schools to assume the various uniforms of the armed forces can best serve if fully prepared. Furthermore, a postwar world will undoubtedly enter new avenues of scientific development beyond the most incredible dreams of the moment. Those who perforce must fight today will be the citizenry to carry on and enjoy the full fruitage of this aftermath of bloody strife in a world at peace.

The War Program of Industrial Arts in the Minneapolis Public Schools

CLIFFORD K. LUSH*

A full wartime program for industrial arts is just taking shape in the Minneapolis schools. The instructors and administrators are beginning to see the real contributions which this field of education may make toward the war effort.

The facilities for industrial arts in Minneapolis are in many respects typical of those in other cities of similar size. There are nearly 200 especially equipped laboratories for industrial arts in the secondary schools, where instruction in 26 areas is given daily to 9000 boys and girls.

In the seventh and eighth grades of the junior high schools, each boy is required to take one hour of industrial arts five days a week. Mechanical drawing and woodworking are taught in the seventh grade; and general metalworking, general electricity, and crafts are taught in the eighth grade. On the ninth grade level, 65 per cent of the students elect a course in graphic arts or an advanced course in one of the other four subjects.

Senior high school students may elect one industrial-arts course each semester, receiving credit toward graduation equal to credit given for any other subject. Last year 68 per cent of the high school boys were enrolled in industrial-arts classes at one time.

Since the equipment varies in the different high schools, the courses likewise differ between the schools, although all schools offer machine woodworking, cabinetmaking, machine drawing, and architectural drawing. Other courses taught are: machine shop, welding, auto mechanics, art metal, printing, electricity and radio, bench metal and forge practice, and aviation drawing.

*Supervisor of Industrial Arts, Minneapolis, Minn.

The War Program for Industrial Arts

From all indications the war *may* last another three years; this means that all the senior high school boys and possibly those in the ninth grade may see service. It is our duty, then, to see that these boys obtain the training which will fit them for their best service to the country. It is reported that two out of three men in the armed services perform some type of mechanical or technical job. No subject, then, should be offered which does not contribute to the training of boys for these duties.

Preinduction courses are especially important for the senior high school boys. The regular industrial-arts courses, if built upon a foundation of war interest and war effort, are valuable for junior high school pupils. Mechanical courses may well be

Code practice and radio repair, Minneapolis, Minn.

offered senior high school girls who may wish to go into war industries, to do other types of men's work, or to do repairing in the home.

The war emphasis in each industrial-arts area has been discussed in several meetings of teachers. Plans have been formulated, courses reorganized, and objectives clarified. The following conclusions concerning the war emphasis in each subject have been made in so far as the present need is indicated. Operation upon an all out war effort is now being attempted.

The Senior High Schools

It is evident that not all boys will be given time by the Army to take a highly scientific training program requiring a great deal of science and mathematics in high school and college. Probably a large number of them will see active service a few months after induction, and they will be running machines or using tools of war of some type. Driving a jeep or a truck or firing an antiaircraft gun requires the basic type of training offered in a good program of industrial arts.

Each branch of service seems to have its own idea of the type of training that all high school boys should have. One group specifies an abundance of science and mathematics; another, preaviation courses; and still another preinduction courses. Attempting to be realistic, we are recommending all three, but matching the requirements with the abilities and interests of the students.

The boy who could not cope with mathematics before the war is still with us and still so constituted. A Pearl Harbor cannot make mathematicians. However, those who do have such ability, but who previously lacked sufficient interest to enroll in mathematics courses, should now be guided toward them provided that they have no other talents which would make them more valuable to the country in other fields. The preinduction manuals recommend that approximately 20 per cent of the boys should be encouraged to take the science and mathematics courses. We, then, are especially interested in the other 80 per cent.

The preinduction shopwork manual furnished by the U. S. Office of Education enumerates desired experiences in several areas, such as woodworking, metalworking, electric wiring, and ropework; and it suggests a single course of instruction to include these experiences. It was decided that with our facilities we would break the single course into several unit full semester courses and to offer them three levels of difficulty as suggested in the manual.

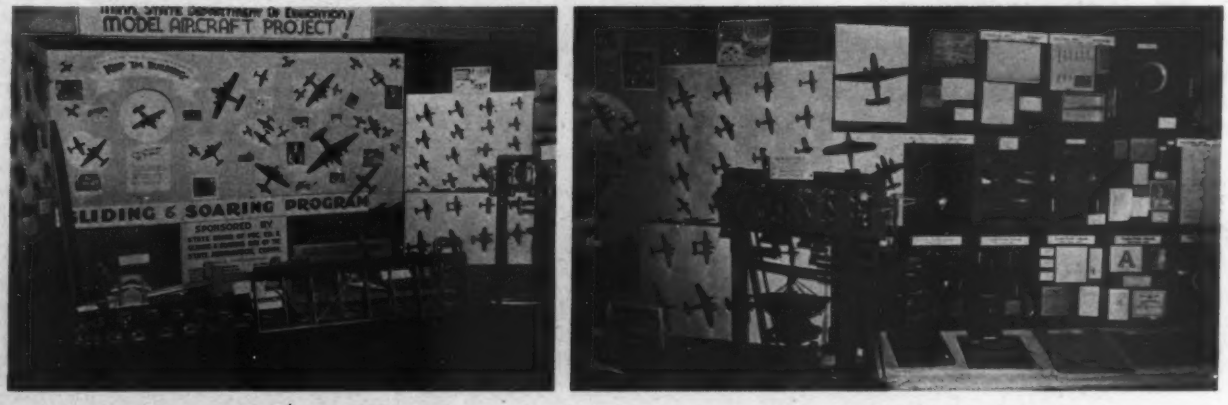
Victory certificates will be awarded to those students who complete two or more preinduction courses on the first level and one such course on the second or third levels.

The first level includes the elementary courses usually for ninth- and tenth-grade pupils; the second level, which is more advanced and specialized, offers courses for the tenth and eleventh grades; and the third level includes the courses for juniors and seniors or for students in the vocational school. Students with the proper background and interest may transfer to the vocational school and take such courses as machine shop, welding, aviation sheet metal, electricity and radio, auto mechanics, or woodworking.

The Preinduction Courses in High School

Woodworking

A first-level preinduction course offers elementary instruction as well as the more advanced type of machine operations. Hand skills are stressed at first, then the machine skills. Plan reading, the produc-



Part of an exhibit showing airplane models made for the Navy by the students of Minnesota

Aircraft models and lamp tables for army camps and hospitals
—Central High School, Minneapolis, Minn.

tion method, and measuring and estimating are considered important elements of the course.

The project method is used in woodworking, but students are asked to make articles for the Junior Red Cross to be used in military camps or hospitals or to make model aircraft for the Navy. Projects selected to be given to these organizations must be analyzed for their instruction content before work is begun on them, so that the instructor is assured of the validity of the training. Building things to help win the war has an appeal to youth and is positive character education.

Construction, using plywood, is studied, but students obtain very little actual experience with this material at present because of the shortage of plywood stock.

Glider Construction

Glider construction is a woodworking aviation course offered for two semesters in those schools which have instructors who have had sufficient training to teach the subject. The Motorless-Flight Program is sponsored in several communities of the state by the State Department of Education. Glider construction is one part of the program. The state furnishes written instructional materials, special supervision, and some of the supplies.

Mechanical Drawing

The first course in this area is classified as a first-level preinduction course. Machine drawing, the second course, is likewise considered a first-level course. Both units stress the study of blueprint reading and precision instruments as well as the usual procedure of drawing machine parts. The interest factor is enhanced by information about the machines of war and of modern industry.

Architectural drawing is now temporarily classified as a nonpreinduction course. There are many boys who still prefer this type of drawing to the others, their explanation being that they wish to specialize in the field after the war.

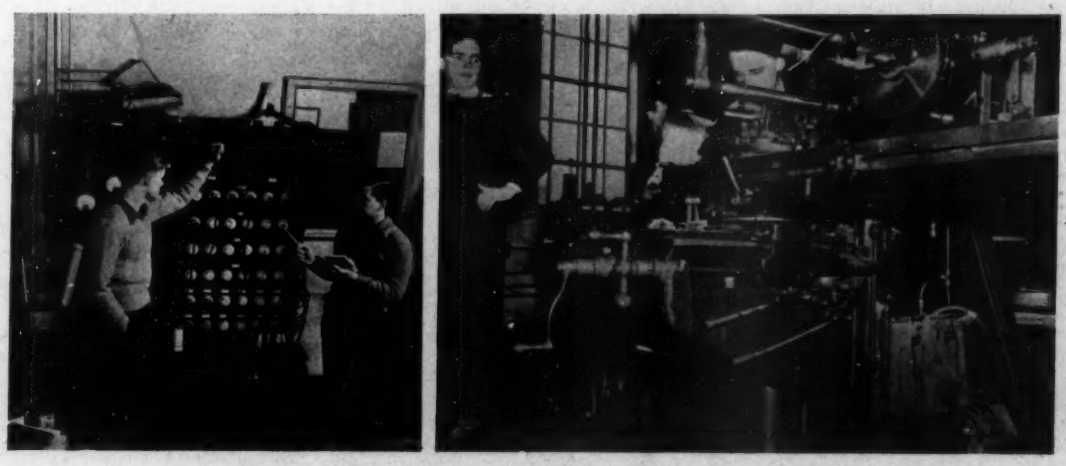
Aviation drawing is offered as an advanced drawing course and is listed as one of the second and third level preinduction courses. It is highly technical for high school age pupils, and only those students who have a fair prognosis for later success in aviation are advised to enroll.

Metalworking

This war, being one of metals, machines, and skills, has a direct relation to the content of courses in metalworking. The first course stresses hand skills and is primarily a bench-metal unit of instruction of the first level for preinduction training. The second course is machine shop or welding.

Although handicapped greatly by the loss of teachers in this area and by the lack of materials, we are attempting to continue with the best instruction possible. Projects requiring a minimum amount of material and a maximum number of operations are selected. More instructional time is devoted to exercises and informational content than in normal times. The care of machines, tools, and supplies is especially emphasized, as well as accuracy, plan reading, and precision instrument study.

Many of the shops in which preinduction metalworking is taught are used for war-



Preinduction electricity and metalwork, Minneapolis, Minn.

production training as soon as the day classes are over so that these shop facilities are in use to the fullest extent.

Auto Mechanics

Realizing that auto mechanics is a very important preinduction course we regret that all our auto shops have had to be closed during the past semester because of the loss of all the teachers in this area to war-production plants or to the armed forces. We are planning to reopen them this fall.

Electricity

This course is taught in the science departments as a science course and in those industrial departments which have the equipment. Where it is part of the industrial-arts curriculum, the first-level for preinduction training attempts to include simple wiring practice and the fundamentals of electricity. A second course is recommended on the second level for those who have capabilities of understanding the advanced units of electricity outlined in the preinduction manuals. Radio instruction follows the advanced course for those who satisfactorily complete the second-level unit of electricity. Code practice is given to those students in either course whose induction is imminent, provided that the students wish such instruction.

The content of the radio course includes first the construction of simple receivers and then the maintenance and repair of more intricate sets. Instructors follow the preinduction outline for radio.

The preinduction outline for the course in machines is definitely a physics course and, where taught in Minneapolis, is given by the science departments. Many pieces of laboratory equipment described in the outline could be made in the shop laboratories for schools lacking such equipment. It has not been necessary in Minneapolis, as our science departments are well equipped. Undoubtedly instruction in levers, inclined planes, and pulleys would be more meaningful to the students if they constructed the equipment for this instruction, but consideration must be made for the time necessary to do so. Also, the lack of teachers for the shops precludes this procedure here.

Preinduction metalwork

The Junior High Schools

Industrial arts in the junior high schools has dedicated its work to war service. The older boys in the ninth grade who may see service with the armed forces try out their abilities to assist them in deciding upon a further selection of the more specialized courses to be taken in high school. Likewise, there seems to be a large proportion of this group who aspire to positions requiring a high degree of training.

Special emphasis is placed upon the making of projects for the Junior Red Cross or upon building model aircraft for the Navy. Exploration opportunities still abound, each student in the seventh and eighth grades being routed through the areas afore-mentioned. Special stress is placed upon the repair of home appliances, the conservation of vital materials, the safe use of machines and tools, and the application of principles to industry and the war.

Printing has gone all out for the production of printed forms, insignia, and the like for school war programs or organizations. Menu covers, bridge tallies, score pads, memo pads, games, labels, and the like, are produced for the Junior Red Cross, to be distributed to the Army camps and hospitals.

The finger dexterity developed in composition as well as in presswork is recognized as valuable training for boys and girls alike. Although printing is not an authorized preinduction course, most of our printing is taught in the junior high schools where we hope the students will not need such preinduction experiences. The postwar values are unquestionable for pupils of this age. However, there must be some carry-over of skills learned in printing to other manipulative courses.

There are two features of the mechanical drawing taught in the junior high school; first, the teaching of the principles of mechanical drawing and second, the teaching of information related to an allied field.

An earlier method of teaching drawing consisted of teaching the principles through exercises, with little or no attempt to relate these principles to a field of interest. All drawings are now concerned with an object or machine part familiar to the experiences of the pupils. The drawing of isolated parts of machines or meaningless block forms is discouraged. Students draw or sketch airplanes, games, parts of familiar simple machines, home appliances, and the like. They also learn to read drawings and to sketch.

Senior High School Girls in Shopwork

The senior high school girls who plan to enter industry after leaving school are encouraged to enroll in shop classes where such groups may be accommodated. Since the metal shops are now already overcrowded with boys, the courses for the girls are given in the woodworking shops. The local employment service has voiced approval of such training in recognition of the demand for women in industrial pursuits.

A typical course for girls conducted in the woodworking laboratory consists of plan reading, the use of measuring instruments, the use of hand tools, the operation of such simple power machines as drill presses and the jig saws. Both the production method and project method are used as well as some exercises.

The Guidance Program

The guidance program has become especially important at the present time; in fact, without an effective guidance service in our school organization such as we have at present, the all-out war program for industrial arts would be almost completely ineffective. It is the counselors and trained home-room teachers who help the students in self-analysis, so that proper guidance is effective.

Students have never sought the guidance services as they do now. Counselors have found it imperative that they obtain sufficient information in order to serve the students during these critical times. Many meetings of counselors have been held, where representatives of induction centers appear and explain the various programs of training, the needs of the ranks, and other information of value in guiding pupils.

The Postwar Outlook

The postwar period will again make many changes necessary in our educational programs of training. Even now, our teachers are giving thought to the training after the war and to implications for training in the junior high schools, where we hope that pupils now in attendance will not need training for active participation on the many fronts.

Undoubtedly, an aviation course will become a *required* subject in the junior high schools, with elective advanced courses in the senior high schools.

The present needs of youth are a sudden departure from normal circumstances, and our actions are but an attempt to formulate an initial program to meet the challenge. Many scientific and industrial developments now being made will have their implications for our field. Consumer education, constructions for better home living, a new insight into the work of the new world, the appreciation of art and craftsmanship, the development of new social ideals, and character education are but a few of the objectives which will have new meaning to our philosophy of the future.

Preinduction, Preaeronautics, and Pretraining

R. A. RADTKE*

One of the greatest potentialities of industrial arts is its flexibility. One needs but turn back the pages of history a few short years to reflect in retrospect the emphasis then placed upon the objectives of this field. Leisure-time activities, home workshops, and the development of worthwhile hobbies were subjects which received considerable attention and emphasis. The country was then in the throes of an economic depression, and one was justified in following the trends of the times. Coincidentally, the world pattern of conflict was still in its embryonic state, and confined to a part of the world which to us was still far, far away, and consequently of little concern. However, events move quickly, and in a few short years this has all changed. The pendulum has swung from far to the left to extreme right, and we are now concerned with the industrial-vocational concepts of industrial arts, rather than the avocational aspects.

Preflight aeronautics, preinduction, preindustrial, and preaeronautics, are terms which recently have become a part of our everyday industrial-arts vocabulary. They represent training programs in which Uncle Sam expects us to take a very definite part in order that we may contribute our share in the war effort.

The War Department in cooperation with the U. S. Office of Education has prepared eight courses of study which can and should be woven into our shop programs. These courses have been prepared for different training levels, and are as follows:

1. Foundational level:
   - *a*) Fundamentals of electricity
   - *b*) Fundamentals of machines
   - *c*) Fundamentals of shopwork
2. Beginning specialization:
   - *a*) Fundamentals of radio
   - *b*) Fundamentals of automotive mechanics
3. Operational skill:
   - *a*) Radio code practice and touch typing
   - *b*) Radio maintenance and repair
   - *c*) Automotive mechanics

These course outlines may be procured from the Superintendent of Documents, Washington, D. C. — price 10 cents.

Secondary schools of the cosmopolitan type should find little difficulty in incorporating the *fundamentals of electricity and fundamentals of shopwork* into their courses of study, unless they are prone to feel that this work is too elementary and is being covered in their regular shop offerings. To some extent this may be true, but if it is possible to provide additional training for those who are going into the armed services or industry shortly, why not provide that training. Ropes, splices, and knots is a new unit to most of us, but with the literature and new supplementary reading material coming off the press daily, one should find little difficulty in weaving this subject into the course offerings.

In considering the possible placement of these subjects, we have these possibilities:

1. Assume that the work you are now doing is sufficient and meets the requirements of these preinduction courses.
2. Organize a one-semester course, offering the *fundamentals of electricity* and *shopwork* to students of advanced standing, who shortly will be in the armed services or in industry.
3. Follow the suggestions of the War Department and U. S. Office of Education, and put each course on a semester basis, preferably for grades 11 and 12.

The third outline in the foundational level, *fundamentals of machines*, is primarily a course in physics, and unless a shop is especially equipped with instruments and materials of this category, this work might better be done in a physics laboratory.

Before discussing further aspects of the courses on the specialization and operational level, recent action taken by the Milwaukee Board of School Directors may be of interest to administrators, directors, and teachers of industrial arts. The board passed the following resolution:

"Your Committee, having considered various suggestions for special military review and preinduction courses in high schools, reports that it has authorized approval by the curriculum director of such offerings by various teachers in some of their classes within the framework of present courses without changes of curricular terminology by the board under its present rules."

This action, as one may expect, is but a temporary expedient; nevertheless, it serves a very useful purpose in eliminating

*Supervisor of Industrial Arts, Milwaukee, Wis.

questions which might arise in relation to credits, terminology, certificates, placement, diplomas, and other kindred subjects.

Continuing with the discussion of the preinduction courses, it is quite obvious that those who prepared this material had a good working knowledge of the capacities, facilities, and the personnel of our secondary, vocational, and technical schools, and have indicated with preciseness the learning level on which this instructional material should be taught. It is now up to the schools of the nation to prove that they can accept this challenge and proficiently perform the tasks asked of them.

It is furthermore obvious that skills still are and will continue to be an important part of any training program. This is a good axiom to remember when conditions return to normalcy.

Reference has already been made to the excellent reference and textbook material coming off the press daily. Since the government sponsored Air-Age Series, and since preinduction courses have come off the press, most book companies have brought out additional supplementary reference material which should be a great aid to those who are adjusting their courses to meet war emergency demands. Industrial-arts directors, and teachers in particular, will be interested in the book, *Aeronautics in the Industrial Arts Program*[1] by Wilbur and Neuthardt. This book, supplemented by another air-age series book, *Science of Pre-Flight Aeronautics for High Schools*, is the answer to the question which many have asked — what can we do. If one has the inspiration, the interest, and the incentive, the following may offer some measure of direction in planning preaeronautics manipulative experiences and activities for senior high schools.

1. Build model planes:
   a) Solid
   b) Flying
2. Study plane identification, using Army and Navy methods.
3. Study aeronautic occupations:
   a) Civilian
   b) Military
4. Make a study or survey of aircraft industry.
5. Construct experimental testing equipment.
6. Aerodynamics:
   a) Theory of flight
7. Visual Aids:
   a) Films
   b) Slides
   c) Pictures
   d) Photographs

The experimental equipment listed in the various books, mentioned in this article, is sufficient to provide more material than the average industrial-arts shop can use in a period of years. The material is there — all that one has to do is find it and use it.

In our philosophy of education, in our pattern of life, in our industrial-arts training programs, and in our democratic way of living for which we are willing to fight and die, there is nothing that should prevent us from adjusting our shop programs to meet the present emergency. The ideas and ideals of a free people can rise to any occasion, if it appreciates the dangers that others have cast for us.

[1]Macmillan Company, 60 — 5th Ave., New York City.

War and the Industrial-Education Program

G. H. SILVIUS*

Industrial education has been called upon to make its contribution to the problems in this war resulting from the shortage of materials, the need for skilled workers in our war industries, and the inadequate training of men in technical fields who are entering our armed forces. In our homes, it is necessary to keep the appliances and equipment in good condition because they cannot be replaced. It is becoming difficult to find a plumber or carpenter to do repair work in the home. The girls in our high schools, and the young men who are physically incapacitated so that they will not be able to serve in the armed forces should be given training for a *pay-roll job* in the war industries. It is imperative that boys leaving our high schools to enter the armed forces receive basic technical training in the preinduction courses outlined by the war department. Industrial education teachers must take cognizance of these problems and plan their work to meet the needs of the youth in the American schools during the war.

Students Emotionally Unstable

Teachers should expect their students to be more emotionally unstable. The adults in the home are working longer hours, and are spending fewer hours with their children. We have inadequate housing facilities in many areas, and mothers will be leaving the homes to work in war industries. Children are concerned over the members of their families who are in the armed forces. Because of these conditions and many others not mentioned, teachers should make every effort to maintain a program at school where the general attitude and morale is on a high level.

Industrial arts will not meet the needs of youth and be interesting to them unless it is organized on an *all-out* basis. Perhaps this can be accomplished on the junior high school level by considering:

The Use That Is Made of the Projects That Are Built

Students will be interested in making projects that will be useful in the war effort. The importance of building projects for productive purposes rather than the student's personal use must be emphasized at this time. Perhaps these suggestions will be helpful in making teaching plans for this year:

1. The United Service Organizations need games, lamps, and ash trays.
2. The American Red Cross is in need of such articles as knitting needles, traction splints, crutches, and stretchers.
3. The Civilian Defense need signs, clip boards and cabinets for equipment; they also recommend that every home have a container for first-aid materials, and that hangers should be made for mounting such equipment as the garden hose, shovels, and the ladder so that they are easily accessible.
4. Toys and play equipment are needed in nursery schools that are being established for the children of working mothers.
5. The repair and care of equipment in the home should provide much worth-while activity in industrial arts, inasmuch as many items in the home cannot be replaced during the war.

The scale model airplanes for the Navy that have been made in our school shops this past year serve as an example of the real educational opportunity for the boys of our country to do their part in this war.

The Conservation of Materials and Resources

It will not be possible to secure sheet copper, pewter, aluminum, galvanized iron, tin plate, and many of the other materials for industrial-arts shops. Perhaps it would be a good policy to plan our courses with

*Assistant Professor of Industrial Education, Wayne University, and Assistant Supervisor of Vocational Education, Detroit Public Schools, Detroit, Mich.

the concept that additional materials will not be forthcoming after the present inventory has been exhausted. Never before has there been the opportunity in industrial arts to stress the importance of conserving materials. The following suggestions may be helpful in reorganizing your work to meet this problem:

1. Smaller projects can be built.
2. Develop a *foolproof* system for issuing stock.
3. When a large piece of stock is being cut into smaller pieces, make sure that the most economical layout has been determined.
4. Use both sides of drawing paper.
5. Eliminate what has been known as the *scrap box*, and find uses for small pieces of stock.
6. Make sure that projects built by students are carefully planned so that they secure the maximum in educational experiences from the materials.
7. Materials now in storage should not be given to the janitor or any other person to build general equipment for the school. Every piece and item now in stock should be used for educational purposes.
8. Perhaps boards and larger pieces of

stock can be resawed to provide a maximum use of the material. Example: 4 by 4-in. stock in the general woodshop could be resawed and used for such projects as file and chisel handles.

9. Every mother has a cutting board in the kitchen that needs to be resurfaced. Why not ask boys to bring them to school so that they can be used in place of new stock in learning how to plane?
10. Solder will become very scarce; perhaps many projects can be redesigned and made by nailing tin plate to wooden parts; this would conserve on solder.
11. Layouts could be more carefully checked by the foreman and teacher to eliminate spoilage caused by incorrect measurements.
12. Perhaps there is material and supplies in some schools that can be shared with other schools.
13. A greater effort could be made to turn off lights, gas-fired furnaces, and electrical appliances when they are not in use.

Making a Greater Use of Salvage Materials

1. There are many wooden boxes that can be secured. If these boxes are taken apart carefully, the lumber is ideal for such projects as birdhouses and shelters.
2. Many uses can be found for salvaged broom sticks, coat hangers, and cigar boxes.
3. In most neighborhoods there is a considerable amount of old furniture that people will be glad to have salvaged for instructional purposes.
4. A large piece of tin can be secured when the rims and double seam are removed from a tin can, which can be used for such projects as sugar scoops and first-aid boxes.
5. In our metalwork, projects can be made from small pieces of salvaged pipe, and old bolts that can be secured from the homes.
6. There are old lamps, extension cords, electric irons, motors, that can be salvaged and the parts used for instructional purposes.

Students will suggest many items that are available and can be salvaged. However, a definite plan must be made for the storage of this material in the school shop. As items are brought to the shop they should be carefully dismantled, cleaned, and stored in bins. There should be a definite storage compartment for each item that is collected. The teacher should be careful not to collect items that cannot be used and fill the shop with junk. Many teachers have found that contests for stimulating student participation in the collection of salvage material have been worth while.

Developing New Activities

Since many of the activities formerly done in industrial arts cannot be carried on during the war due to the shortage of materials, it will be necessary to develop others to replace them. The following suggestions may be helpful:

1. In the lower grade levels more activity could be developed by projects made from cardboard, wire, and linoleum.
2. More emphasis could be placed on projects made by whittling and carving.

A high degree of workmanship is required in making model planes for the Navy
—Courtesy, The Detroit News

The development of jigs in themselves are excellent shop projects

3. Many boys will furnish kits that are still available for making model airplanes, automobiles, and boats.

4. A greater use can be made of the repair units in household mechanics, such as, putting new washers into compression faucets, studying the mechanism of a flushing tank, wiring bell circuits, and cleaning drain traps.

5. Much worth-while activity can be built around reconditioning the tools and equipment in the shop. Many of the machines need to be refinished, oxide could be removed from the hand tools, workbenches can be refinished, tool panels painted, new racks developed for holding the tools, and handles should be replaced on hand tools when they are cracked or worn.

6. Several boys will be interested in an experimental activity consisting of developing new and useful projects that can be made from available salvage material, and the small pieces of stock that have been considered scrap in the past.

7. Students will be interested in bringing appliances and equipment from their homes and repairing them in the school shop. Could we think of a finer project than to have a boy repair a vacuum cleaner in the school shop that his parents could not replace until after the war?

8. Many pupils are interested in collecting and displaying bulletin-board material. Since there are so many interesting pictures available dealing with our war-industrial activities, it would be a splendid opportunity for a committee of students to take charge of the shop bulletin board.

9. There is a great deal of worth-while reference material that can be tied up with the projects that are built. Perhaps a greater use could be made of the material in our shop libraries.

It will be possible to develop new activities that are worth while when we have a democratic procedure; this can be accomplished when teachers secure the suggestions and cooperation of their students and then in turn pass along worth-while ideas to other teachers. As we are put to the task of meeting these problems, much that is good will be added to our industrial-arts program.

Industrial Education in the Secondary Schools

Industrial education for boys on the high school levels should be the preinduction courses outlined by the War Department. These course outlines are being released through the U. S. Office of Education, and are based on technical training that will meet the needs of our young men who will be going from the secondary schools, directly into the armed forces. In our mechanized army, 63 out of every 100 men must become technical specialists. Ten to forty weeks are now required by the army for this training in their schools after 13 weeks of basic training. Only 55 per cent of the white and 33 per cent of the colored men who are now in the armed forces have skills that can be used. There are 414 types of specialists in our army.

These courses are on three levels:

1. Foundational, or first level:
   - *a*) Fundamentals of electricity.
   - *b*) Fundamentals of machines.
   - *c*) Fundamentals of shopwork.

Each course is planned for one semester, 90 periods.

2. Beginning specialization, or second level:
   - *a*) Fundamentals of radio.
   - *b*) Fundamentals of automotive mechanics.

Each course is 180 periods, two semesters, for one school year.

3. Operational skills, or third level:
   - *a*) Fundamentals of code practice and touch typing.
   - *b*) Fundamentals of radio maintenance and repair.

This third level will also include many of our regular shop courses. However, at this time, the most fundamental and acute needs are those mentioned.

Victory certificates will be given to the young men as they complete these courses.

The present plan is to have the victory certificates attached to the induction papers. The army will give tests to the inductees to determine what they already know and can do, and then they will start where the schools leave off; this will cut down on the time, 10 to 40 weeks, now required for the technical training.

troit area, provides for this training at the end of the regular school day or on Saturday. Since our school shops throughout the nation have been used so successfully for training adults for the war industries, it would now seem advisable to schedule girls during the regular school day to these shops, and give them pay-roll training so

The Teacher's Part

When shop teachers are called upon to carry out an assignment in the schools in connection with the war effort, they should feel that they are fortunate to be in a position to render service in the *all-out* effort to win this war. They should make every

The Denby High School boys build stretchers for the Red Cross

Many industrial-education teachers are now teaching the preflight courses in our secondary schools. This program is sponsored by the C.A.A., and is completely outlined in leaflet No. 63, Pre-Flight Aeronautics in Secondary Schools, distributed by the U. S. Office of Education. This course includes work in orientation, structure, aerodynamics, power plants, communications, meteorology, avigation, and gliding. It is intended for boys who will be going into the military flight officer occupations. It is not intended for boys who are interested in the ground-crew occupations. Boys who are interested in the ground-crew occupations should be enrolled in the preinduction courses.

The vocational training for the war-production program is now authorized to give training to high school youth who are in regular attendance in the schools. This *pay-roll* job training is given in areas where there is an authenticated shortage in the local industries. The young people enrolled in these classes are graduating seniors, registered with the United States Employment Service. The plan at present, in the De-

that they will be ready to enter the war industries when they graduate from high school.

The Adult Education Program

The vocational training for war-production workers is well established and is meeting the needs of the war industries in preparing adults, especially women, who wish to rehabilitate themselves so that they can work in essential industries. However, there is still an additional job that must be done in the school shops and drafting rooms. Men not now in school, who are due to be inducted into the armed forces, should be enrolled in preinduction courses, those same courses that are planned for the young men in grades 11 and 12 in our technical, vocational, and typical high schools. There are 600,000 boys graduating from high schools in the United States this year. This will only meet the needs of the armed forces for a period of six weeks. It is obvious that the facilities of our schools for preinduction courses must also be extended to men who are now out of school.

effort to enter into these projects with the enthusiasm that in turn will be transmitted to their students. Students should participate with the feeling that it is an educational opportunity, and not an undesirable task that must be performed.

The acute shortage of qualified industrial-arts teachers will mean added responsibility for those who are left to carry on the work. Many regular teachers will be called upon to help substitute teachers who are being employed to keep the program going. As teachers are called to the armed forces, it may be necessary to transfer men to other teaching assignments during the war, and in many cases, it will be a difficult adjustment.

Industry is in a position to make lucrative offers for the services of industrial-education teachers. It may seem like a sacrifice to remain with the profession and pass up the *big money*. However, teachers who are interested in the influence that they have on the youth under their direction will remain with the profession, where they are in a position to render the greatest service.

Relation of Industrial Arts to the War Industries

R. H. ROBERTS*

As we review the tremendous task with which our nation has been confronted in training workers for our war industries, we cannot help but ask ourselves what contribution industrial arts has made toward the basic training of these workers.

At the beginning of this training program a large percentage of the trainees were young men who were recent graduates of our high schools and who were interested in this kind of work. Most of these young men had received no further training, nor had they been able to find jobs which gave them additional training. Here, then, was the opportunity to determine just what the industrial-arts program has contributed in the training of these workers for our war industries.

Those who have been in a position to follow closely the record which these young men made during their training period, and since that time on the job, are unanimous in their conclusions that the industrial-arts program in the secondary school has made an excellent contribution toward the training of these young workers. They have concluded that the industrial-arts courses have emphasized the important needs in the foundation training for industry.

This further observation should be made, however, in order to be clear in these conclusions. The group which we have just mentioned came largely from communities in which the advantages of a strong industrial-arts program was available. This was normal, because the war industries schools are located in such communities and these young men were first to take advantage of these training opportunities. A large number of these men have advanced rapidly in their work, have become *lead men*, and are now considered almost indispensable to the industry.

Closely related to this point in our discussion are two or three other observations which close observers of this program have made: (1) That students who have had thorough training in one field of industrial-arts work readily acquire the necessary information, and develop the necessary skills in another field. (2) That broad, thorough training *in one field* is more valuable in the preparation of the future workman than a hurried and sketchy training over several fields. This is true even though the worker does not follow the field of work in which he has had his major training. (3) That good work habits, the attitude of willingness to learn, and ability to analyze the steps of procedure involved in the job are paramount to success on the job. These things have been stressed in any well-organized industrial-arts program and the results are quite obvious.

*Central High School, Tulsa, Okla.

Guidance: An Important Contribution

Perhaps the one most important general contribution which industrial arts has made toward the preparation of workers in the war industries is guidance. Beginning in our junior high school program and continuing through the senior high school, this department contributes generously to vocational guidance. The opportunity to sample, through the various *exploratory* courses offered in our junior high schools, the work and experiences involved in several types of jobs or trades represents a saving of much time on the part of the individual worker and of industry. It is obvious that the boy who experiences an utter dislike or a lack of aptitude for a certain field of work will not make the mistake of attempting to enter that field or take further preparation for it. This experience has undoubtedly guided a large number in their choice of training which they have taken in preparation for working in the war industries. Obviously, it has not been possible to set up a program which will allow the student to explore and to experience something about each of the large number of occupations. We do not attempt full coverage, but it is possible to give students guidance in broad families of occupations.

Much important information about the various occupations is also presented during the junior high school years. Sooner or later every workman on the job needs this information. It is not so technical or detailed but that the average individual will retain it indefinitely.

In the senior high school the use of written instruction materials and visual aids to give job descriptions and general industrial information has contributed much to the young worker's knowledge of what is expected of the worker in the plant. Through these media, the student also learns what manipulative skills are required. Visits to industrial plants also contribute much to the general knowledge of the industrial-arts student and helps him understand the job of the worker in each field.

Finally, the offering of these work experiences gives the industrial-arts instructor an opportunity to observe the abilities, and to discover the aptitudes of his students, so that he has a basis for future reference, recommendation, and guidance. Today as never before, industry is asking for these recommendations and is placing considerable confidence in the judgments of the instructors.

Thus far we have dealt with the general contributions which have been made. Let us now give consideration to the more specific things which the industrial-arts student has experienced which make him more valuable to the industries connected with war production and which make him better prepared for the training program which he must complete before entering these industries:

1. He has learned the names of the tools used in the industry. In addition to this, he has learned how to take care of these tools, the quality and variety of tools and the names of manufacturers of tools.
2. He has learned how these tools should be used and has acquired a certain amount of skill in using them.
3. He has learned how to operate and has acquired some skill in the use of simpler machines of the trade. Through visitation of industrial plants and visual aids, he has learned the general principles of the workings of other machines in the industry.
4. He has learned how to use the measuring instruments of the trade and knows the measuring units involved in the measuring system.
5. He has acquired considerable skill in the manipulative processes. The degree of this skill will be largely dependent upon the number of years which each course has been offered.
6. He is well versed in the nomenclature of his field.
7. He has developed some skill in the application of the mathematics involved in his field through the figuring of cost of materials, and layout and construction problems. The fact that he has had an opportunity to use his mathematical skill in a practical way has also stimulated him to show more interest and receive more benefit from the mathematics courses which he has completed.
8. He has learned much of the science involved in his field. His general knowledge of the functions of machine parts, how they develop speed and power, the principles of mechanical advantage gained by the lever and other such mechanical devices, the principle of hydraulics and of electricity,

make him well versed in the field of physical science. The fact that he has an opportunity to apply these principles in his shop work helps him to retain the practical phases of his science study.

9. He knows how to read a blueprint and how to make a working drawing. Since drawing is the universal language of every trade, this is an important factor in his work. Most of the jobs in our war industries require the ability to read blueprints.

10. He has learned how to use written instructional material and knows the sources of such material. This is important because he receives written orders and written instructions on the job. He must be able to understand these instructions and to follow them. The fact that he knows where to find these written instructional materials and that he has developed the habit of using them, also aids him in future growth on the job.

11. He is acquainted with the available books, magazines, trade journals, and other literature of the field.

12. He has a good working knowledge of the materials used in the field and is able to judge the qualities of these materials. He also knows how to use these materials properly, where to secure them, and he knows their general properties.

13. He has developed good work habits. He knows that there are correct as well as incorrect ways of doing things, and he knows why these are correct. He knows how to organize his work so that he will make the maximum use of his time. He is able to quickly recognize the difference between good workmanship and poor workmanship. He has developed a pride in doing neat, careful, and accurate work. He has acquired the ability and the habit of making maximum use of the materials with which he is working. He has developed the habit of keeping his tools in good condition and in an orderly and convenient arrangement. Above all, he does not abuse his tools by substituting one kind of tool for another simply because he is too thoughtless, indifferent, or lazy to put forth the necessary effort to secure the proper tool for the job. He keeps his shop in a neat and orderly manner. He displays the attitude of cleanliness of speech, person and habits, acknowledging that these are just as important among workers in industry as in any other group. He has adopted the attitude of honest work for honest pay.

14. He has developed the proper attitude toward work and toward industry. He is aware of many of the problems of industry and has developed an open-minded attitude concerning these problems. He knows something of the contribution that industry has made to our civilization.

15. He has acquired considerable information about the requirements of safety and health in industry. He has developed the habit of following safe practices in his work and knows what safety measures are required of every workman. He has developed an interest in the safety and health of his fellow workers as well as his own. He displays a willingness to guard his own health and the health of others.

16. Through the various forms of pupil personnel organization developed in our school shops, he has learned how to work successfully and harmoniously with others. He has learned how to take orders as well as give them. He has learned the proper line of responsibility and authority, and has acquired the habit of following these in all of his relationships on his job. He has also developed the attitude of accepting his full share of responsibility toward his job.

17. He has learned the principle of *team work* through his participation on group projects and has developed a democratic attitude toward this type of work. He knows how to *pool* his efforts and his abilities with those of his fellow workers for the common objectives.

18. He has learned to accept instruction, advice, and suggestions with good grace and has in turn displayed the willingness to share his knowledge with his fellow workers. He has overcome the *know-it-all* attitude and displays a desire and willingness to learn.

19. He has constructed, he has shaped, he has put things together and has taken them apart. Through these experiences he has developed a sense of how to get the job done — an important matter when working in an industry.

20. Since the nomenclature, the tools and tool processes, the measuring instruments and units, and many of the skills of the various fields of industry are quite similar, the industrial-arts graduate has acquired many things which will make it comparatively easy for him to shift from one field of work into another.

Some may be inclined to minimize some of these matters, but to be convinced of its value, one only needs to think carefully about the problems which industry would face had our schools failed to train any of her students in any of the fields of industrial arts. Compare the abilities of the purely academic student with that of the industrial-arts student when it comes to handling of tools and doing some simple construction or repair job. That will be evidence enough to convince anyone of its value.

New Services Offered

This department, however, is not resting satisfied with a splendid record of the past. It is *streamlining* its program to fit more closely the needs of the present crisis. It stands ready to do everything possible to be of more service to the young people of the community and to the war effort. No department in the school has a heavier responsibility in this matter, nor is any department more capable of fulfilling its obligations than is ours.

First of all, every industrial-arts teacher is changing the objectives of his course to fit more closely the needs of the student in preparing him specifically to enter civil-service jobs as inspectors, the air corps, the navy, the army, or some war industry. These changes in some cases involve a change in course content, others emphasize more skill in certain specific manipulative processes, and still others narrow their work down to fewer units, but aim at more thorough coverage of these units.

Some industrial-arts departments have set up new courses and have equipped new shops to give instruction in such work as aircraft metalwork, aircraft installation work, and aircraft mechanics. Such is the case in Tulsa. These classes have been organized on an industrial-arts basis in order to give an opportunity for a greater number of students to receive the training. The classes meet for a double period each day which would give the student a total of 360 hours' training plus the homework which they are assigned. As nearly as possible the same instruction is given to the high school students as the adults get in the regular war industries school. The trainee is trained for a period of 240 hours with no homework. Thus we can see that these students should be well prepared to step directly into a war-production job as soon as they complete one of these courses.

Tulsa's woodworking shops are devoting a large share of their efforts toward training students along the line of aircraft woodworking. The students are doing airplane model building, wood-wing construction, and glider construction work. This new emphasis has added much timely interest to the course and these students are gaining considerable skill in doing the identical job which they will do when they enter the aircraft industry. This program is also contributing materially to the development of an "air-minded youth."

The machine and metalworking shops in Tulsa's industrial-arts department are limiting the tools and machines which the student uses and are stressing the development of more skill in their use. They are stressing the development of machine operators rather than machinists.

It has been observed that the individual best qualified to enter many jobs is the one who has been trained in bench metalwork. Much of this training can be given on the junior high school level, thus beginning this work early enough for the student to acquire considerable skill even before he completes his senior high school work. This also provides an excellent basic foundation for the machine-shop course during the senior high school period. The metal shops in Tulsa have been stressing this point strongly in their program.

Our electrical shops are also becoming

aware of the tremendous shortage of people who have had training in electricity and radio. Therefore, these shops are stressing the fundamentals of electricity, enough shopwork is given to acquaint the students with the common tools and equipment of the general electrical shop and some of the principles of radio. It has been suggested that every electricity teacher in our secondary schools should make a special effort to ascertain what kind of training is needed to supply the demands of our armed forces. It is further suggested that these courses might emphasize one of the following: (1) What is defined by the Air Corps as electrical shopwork — where the student learns to make certain connections, splicing, and other fundamental manipulative work included in the field; (2) the possibility of doing considerable code work including Morse code; (3) radio repair work.

For many years the drafting department of the Tulsa schools has been giving considerable training to her students in what is called *map work*. This training has been found to be very much in demand now as our army is badly in need of men who are able to interpret these maps and also to make them. The War Department calls this *topographic drafting*. Another very pressing need, among those who go to work in our war industries and those who enter the technical service in our armed forces, is the ability to read blueprints. Our drafting departments cannot stress this training too strongly.

Provisions should be made in every industrial-arts department to remove from these classes those students who do not show aptitude for the work and who lack the ambition to show reasonable progress in the work. This is for the purpose of giving room for other students who are ambitious to take the work and who do show aptitude for it. Every shop should be kept to the maximum of its capacity for training and should accommodate, as nearly as possible, every boy or girl in the school who is ambitious to enter the field.

Safety should be stressed in our teaching more than ever before. The pressing of abnormally young, inexperienced, and inadequately trained workers into our war industries makes it the more important. Every day of loss to the worker, because of an accident, retards our production program and thereby prolongs this war. Frequently carelessness and thoughtlessness are the causes for breaking tools and machines. This causes the machines and tools to stand idle for repair and also makes it necessary to use strategic materials which are so badly needed in the defense of our nation.

Girls Should Receive Training

With the induction of 18 and 19 year olds into the armed service, and with the first choice of available skilled men going to the armed services, it is easy to see that the jobs in industry must be filled with youths under the draft age and with women. Therefore, it follows that our industrial-arts program must offer every opportunity to the girls in our secondary schools so that they may receive the same training which our boys are receiving. Furthermore, girls must not only be encouraged to test out their aptitudes for shopwork, but must be *urged* to make every effort possible to determine whether or not they have special abilities which would help them to become successful in some of these special fields.

Our schools must immediately set up a testing program which will help to find those girls who show promise in this work and set up a series of short courses which will give these girls an opportunity to try out their abilities. Experience in England and in some of our own factories has proven that women are capable of doing many of these jobs just as satisfactorily as men, and the girls in our high schools will prove no exception. Once the *ice is broken*, these girls will be found to be capable students, providing some preliminary guidance has been given.

With the industrial plants all over our country anticipating that from 50 to 80 per cent of their workers during the coming 12 to 18 months will be women, it is clear that our schools must provide opportunities for girls to receive this training. One war industry plant in Oklahoma employing 5000 workers anticipates that in a short time 75 per cent of these workers will be women.

This program should only be offered to those who are in their junior or senior years, preferably the senior year. This is to take advantage of the maturity of the individual and also in order that the skills developed may not become rusty before the individual is placed on the job. Our industrial-arts shops are peculiarly adapted to offering this service and our program is flexible enough to accommodate this program without undue hardships brought upon the school.

Our Department Charged With Responsibility

Late last August, John W. Studebaker, U. S. Commissioner of Education, met with 500 educators who assembled in Washington in a National Institute on "Education and the War." At that time these educators were told quite plainly what must be done in education to help win this war. These assignments fell most heavily in their implications on one group — the nation's industrial arts and vocational education teachers.

"What the Federal Government wants from education, in brief, is a reserve of secondary school pupils who can handle tools, read maps and blueprints, who have respect for thoroughness and technical precision, and who will be qualified to enter advanced technical courses. One observer put it that the Federal Government now wants from secondary education what Germany has been giving its youth for a century and Russia for a generation.

"Washington is now agreed that it will be a long war — at least five or six years, followed by an even longer armed peace. Therefore federal officials look on the 7,000,000 secondary school students as one of the greatest reservist armies in the nation, and the school shop as its greatest training ground."

Just what do the Army officials say they want in the way of trained men? Speaking on the need for educational assistance in the army training process recently, this is what General Somervell, Commanding General of the Army's Services of Supply, says: "Our army today is an army of specialists. We aren't getting those specialists through the induction centers. But modern, merchanized warfare dictates that we must have them . . . these shortages of trained man power are serious . . . the situation is not getting better. It is fast getting worse."

General Somervell goes on further to say that the army needs one trained radio operator for every 65 inductees, but is getting only one in every 2220. On January 1, 1942, out of every 1000 men inducted the Army needed 15 who had training as radio operators. In the two months beginning with February 1, 1942, through March 31, 1942, the Army was getting less than one man per 1000. Actually out of every 300,000 men inducted, they needed 4689 with training as radio operators. They were getting 135. Out of every 300,000 men inducted, the Army needed 4372 telephone and telegraph linemen. They were getting 343. They needed 1562 master mechanics. They were getting only 14. In the field of automotive mechanics, out of every 300,000 men inducted, the Army was short 10,434. That means a shortage of 34,790 out of every 1,000,000 men. In an army of 4,000,000 men there is a shortage of 139,160 automotive mechanics.

With these figures in mind it is not difficult to see what the task of secondary education is. General Somervell further stated that, "It is the job of the schools and colleges to provide the opportunity for every youth to equip himself for a place in winning the war. This must be done regardless of cost, time, inconvenience, the temporary sidetracking of nonwar objectives, or even the temporary scrapping of peacetime courses."

Services Performed for War Agencies

Another practical service which our department can render in the present crisis

is that of constructing many items of recreational and serviceable equipment for the recreation centers of our army camps. The Junior Red Cross organization has asked the schools for their assistance and our school shops are responding generously. Tulsa's metalwork, woodwork, and electrical shops will produce approximately 3000 items for the Junior Red Cross this year. A partial list of these articles are:

240 ash-tray stands made of wood.

500 ash trays made of tin cans and in several designs to fit the stands just mentioned.

300 nonbreakable ash trays. These are being made of tin cans and are spun on a metal lathe.

100 floor lamps made of wood.

300 lapboards for games or for convalescents confined to wheel chairs.

140 table lamps.

450 writing boards for bed patients.

A large number and variety of other articles.

These projects furnish an opportunity for these shops to carry on at least one production job and thus give the students some experience comparable to that which they will meet in industry. Some of these items will be made on a cooperative plan where the metalwork shops will turn out the metal parts and the woodworking shops the wood parts. In many cases these projects challenge the ingenuity of the students to use materials that are not classed as essential materials. The use of tin cans was the answer to the problem of making ash trays. These have been cleverly designed and include several manipulative processes which give the students excellent training and practical experience.

Last year all of the woodworking shops in Tulsa, as did most of those in the state, participated in the making of the model airplanes which the United States Navy requested from the school shops all over America. These shops were not able to complete their quota before the end of the last school term but the remainder of these models are to be completed during this term. The students of these shops also made a large number of supply kits, splints, stretchers, and other supplies for the Junior Red Cross organization. They also made a large quantity of police clubs to be used by volunteers in our Civilian Defense organizations.

With the challenges which we have before us then, and the many opportunities which are presenting themselves each day, the industrial-arts teachers in our secondary schools have an important part to play in the war effort. Therefore, our one thought should be to meet the needs of these times in training the young men and young women who in a very short time will find themselves in our armed forces and in the war industries of our nation.

Responsibility of Industrial Arts in the Present Crisis

W. C. GIESE*

Industrial arts in wartime has responsibilities that are quite different from those encountered in peace time. Before discussing these responsibilities that confront industrial arts in the present crisis, it might be well to examine the conditions that may bring about the discontinuance or curtailment of industrial-arts training in our high schools during the war years.

The technical skill which our teachers possess, the machines and the tools with which our shops are equipped, are sorely needed in our war industries. There are persons who believe that schools could help most in the war effort if they would release shop teachers and shop equipment to industry or to the armed forces. Some of these persons are executives in industry, some are members of draft boards, and some of them, oh heresy of heresies, are or have recently been teachers of industrial arts.

It is only too well known what problem the schools face in procuring tools, machines, and supplies in these days of priority regulations. It is difficult, in fact, almost impossible to replace worn-out machines. Some schools have found it extremely difficult to get any steel stock for machine-shop instruction. These difficulties, however, can be surmounted. Most worn or broken parts of machines can be replaced or repaired, and machine-shop instruction can be carried on with stock furnished by some local war industry if the finished product coming out of the school shop can be used by the industry.

The greatest problem that confronts instruction in industrial arts during the war period, however, is that due to teacher shortage. Many teachers of industrial arts in our state have enlisted, or have been taken by the draft, or have given up teaching to take jobs in industry. It is practically impossible to find a replacement for a shop teacher. In some areas draft boards have ruled that they cannot grant deferment to industrial-arts teachers even though the school will find it necessary to close shop classes. In other areas deferment has been granted by local boards in spite of the fact that the selective service regulations do not include industrial-arts teaching as an essential occupation in the war effort. Enlistments and the refusal of some teachers to accept deferment has increased the severity of the shortage. These inroads on the supply of teachers are in themselves serious but added to these are the losses that have resulted from teachers transferring to jobs in industry. This latter number may not be great but such transfers have taken place and as a result industrial-arts instruction has been seriously handicapped or curtailed in some communities. Increased pay may not have been the sole reason for such transfers; in fact, have been only a minor consideration.

The shelter of the schoolroom or the school shop where business is being conducted as usual has become irksome to some teachers who want to feel that they are making an immediate and direct contribution to the war we are now fighting. To build the tank that will soon rumble off the assembly line on its way to the fighting front; to help build a submarine that will soon be darting through the waters in search of enemy prey; to construct the guns that will soon be hurling their death dealing projectiles to defend us; or to have a part in the building of the planes that will soon be hunting the enemy in the skies; must give one a very real sense of having a part in the struggle in which our nation is now engaged. Teaching as usual seems so far removed from the intensity of this struggle. If one can participate in the feverish pace of production in our factories one can feel the throbbing effort of our country at war. Many teachers who have worked on war-production jobs during the summer have had an awareness of urgency, of increased effort, which make the tranquil atmosphere of the schoolroom seem far removed one might say, almost unconcerned with the war.

This summer the writer had a conference with one of his teachers who wanted a leave of absence so that he could continue on the job of untangling, for one of our war industries, the changing yet continuous tangle of war priorities. "I feel," he said

*Superintendent, Public Schools, Racine, Wis.

"for the first time that I am in the current of things. I am no longer a bystander. I can't go back to the classroom without feeling a letdown and I couldn't put enthusiasm into my work." The man happened to be a teacher of English, but I know the teachers of industrial arts have had a similar experience.

Teachers of industrial arts, however, cannot yield to such an appeal without denying the very basis of industrial-arts education. If these teachers do not feel that industrial-arts education is important enough in these war days to hold their services, then it never had any justification at all. Every claim that was made for the introduction of industrial-arts training into the school curriculum must have greater weight in these days or it never had any validity. Teachers dare not forsake their classes now without laying themselves open to the charge that they never really believed in the worth of what they were doing, and that they were preaching in our educational councils a faith they did not hold.

Teachers of industrial arts can be of most help in the war effort by staying in the classroom and continuing their work of training new hands to take up war jobs. A boy of twenty was in my office a few months ago. He wanted me to write a letter recommending him for the air corps as an aviation mechanic. I learned upon inquiry that he had been employed for almost two years since graduation from high school as a gear cutter in one of our plants working on a war contract.

"How did you learn to be a gear cutter?" I asked him.

"Well," he replied, "I learned the fundamentals in my machine-shop course in high school and after a little special training in the plant I was given a job demanding high precision and considerable skill. I could not do the work I am now doing if my training in machine shop in high school had not given me a head start. I know this training will also enable me to make good as a mechanic in the air corps if I can get the appointment."

The personnel manager of a large industrial plant in a near-by city told the writer that he had employed the head of the industrial-arts department of one of our senior high schools during the summer vacation, for making a layout locating the machinery for a new addition to the plant. He requested a leave of absence for this department head until the work could be completed. It was pointed out to him that it would be impossible to get a teacher to take over the work this department head was doing in the school, and that his absence would probably necessitate the discontinuance of his classes until he returned.

"If that is so," the personnel manager replied, "we do not want him. He has proved almost invaluable to us but I believe he is even more valuable in the school. It would be foolish for us to shut off the source of supply from which additional trained workers will come."

Not all personnel managers or members of draft boards have the wisdom this man showed. Some of them are chiefly concerned with solving an immediate problem although the present solution creates greater problems in the very near future.

The first responsibility of industrial-arts education in the present crisis is to increase the scope and extent of the instruction offered. Curtailment of instruction at this time will most certainly hinder the war effort.

What form shall this program of expansion take? It seems clear that the immediate needs of the war industries in our communities should have serious consideration in shaping any course of instruction we now offer. Quite properly, we have deprecated in the past a program of instruction which was limited to teaching specific skills. Rather have we tried to teach fundamentals of shop practice, tying in with such instruction related information which will have general educational as well as vocational values. The aim of industrial-arts education has tried to keep in mind the development of the individual rather than the benefits of industry. We have been concerned about developing interests which would find expression in activities for leisure hours, and in developing skills and understanding which would enlarge the vocational avenues rather than limit too narrowly the vocational choice. Now, however, we should give first consideration to the needs in our communities.

Employment managers and shop superintendents should be invited to counsel with us and to plan with us the courses of instruction that will make our pupils efficient producers in the shortest possible time.

Svend Pedersen, director of education of the Lockheed Aircraft Corporation, makes the following recommendations to schools that wish to do a more effective job in training workers for industry:

1. Select courses of study to fit specific needs of the industry. This means collaboration through an advisory committee on the part of schools, management, and labor.

2. Induct high school seniors who are interested in and have aptitude for specific jobs into orientation training classes in subjects common to all plants in that industry — processes, materials, nomenclature, shop practice, safety regulations, etc.

3. Don't try to supplant on-the-job training in unit skills. Give opportunity for manipulative practice in basic skills common to all jobs in the specific industry.

4. Use all training media including visual aids, sound slides, movie films, film strips, that will emphasize a practical approach to shop practice.

If these recommendations are interpreted correctly they indicate much less departmentalized instruction in industrial arts than is commonly practiced. For those pupils, especially, who are enrolled in industrial-arts classes for one year only, a general orientation course will have greater value than a year of mechanical drawing only, or a year of machine-shop work.

As the program of war production expands a continually increasing number of workers must be found to man our factories. The armed forces have already taken a large number of men out of industry and further drafts on industry's man power must be replaced by the employment of women. In no other way can the flow of fighting equipment from our war industries be sustained. The want ads of any daily newspaper in any war-production area are an indication of the increasing demand for women workers. Here are some of them:

Electrical Workers

Young women for work in the following occupations in connection with the manufacture of electrical apparatus: assemblers, machine operators, counters and packers, glass workers, inspectors, solderers, testers, wiremen.

Women: For drill press, milling machine, and hand screw machine operations; none now engaged in other war work need apply. Interviews, Sunday 9 to 12.

Girls — 18 to 25

College and high school graduates, on defense work to learn machine work. In reply give full particulars.

Girls — For drill press.

Girls for lathe and machine operators.

Should be able to read scales and blueprints. In reply give age, education, experience, salary desired, and phone.

Electrical Testers

No experience required. Young women to learn electrical testing on defense work. Some knowledge of trigonometry and physics essential.

Has industrial-arts education in our schools any responsibility in helping to train these women workers who are to take the place of the men who have joined our fighting forces? There can be no doubt that in the present crisis courses of instruction should be organized for high school girls which would make them more efficient workers when they enter the factory doors. Obviously much of this instruction must be specialized in nature and probably will not have permanent values when peace has come again and these girls resume the normal occupations and the normal activities the women of our country will follow.

A few weeks ago Mr. Harlan Shufelt, supervisor of industrial arts for the Racine school system, interviewed the personnel

managers in a number of our industrial plants. These men were unanimous in the opinion that the schools had an obligation and an opportunity in the training of future women employees. As a result of the recommendations Mr. Shufelt received we are organizing special classes for high school girls which will meet on Saturday. The enrollment is not yet completed but already over one hundred girls have enrolled for this course of training. The course of instruction planned for these girls will include electricity (there are three electrical plants in our city), blueprint reading, machine-shop practice, use of gauges and precision measuring instruments, shop organization, and shop safety. We do not know just what these girls will do when they take their places as factory workers. Some will be inspectors, some testers, some assemblers, and some machine operators, but we hope that all of them will face their new tasks with a greater degree of confidence and competence because of their high school training. Surely it is the responsibility of industrial-arts educators to help these girls make the adjustment to the new and strange jobs the war effort will call upon them to perform.

Preflight Training

HARRY R. WILSON*

In the years preceding Pearl Harbor there were many in our school system who saw the rapid advance of the air era and who also realized how our present-day enemies were preparing for this new age through their public schools. During these prewar days we proceded blithely on our way ignoring these "voices in the wilderness." Then Japan struck, and we realized that something must be done and done quickly. The matter was serious.

Due to her preflight training in the grade and high schools, Germany's production of airmen was twice as rapid as ours. Boys left the German schools with a knowledge of aviation which halved the time required to train them for actual war conditions. We realized, hoping that it was not too late, that our educational system had been caught napping. The Japs provided the final spark, and the schools are getting down to work to "air condition" the youth of the country and not only win the war but give us our rightful place as leaders in the air era.

What shall we teach? This question presented itself at once in the minds of our high school principals and others in the grades. Then another question arose: How can we adapt present equipment and teaching personnel to an air education program? In order to answer these questions let us take a look at the aviation field in general.

A pilot should know how to fly a plane safely and skillfully; how to recognize safe weather conditions, and he should know sufficient about his airplane and engine to recognize defects and to be able to "shoot trouble" in an emergency. This would include a knowledge of navigation, meteorology, aerodynamics, structure of aircraft, aircraft engines, instruments, civil air regulations, and radio. Another keyman in the flight crew is the navigator. His job is to take the airplane from place to place, arrive at his destination on time, and know his location or "fix" at any time during the journey. In order to do this he should have a good knowledge of mathematics, geography, meteorology, and instruments.

We should also remember that for every one man in the air we need 15 men on the ground in order to keep him flying. These include mechanics, both aircraft and engine, radio operators and mechanics, photographers, instrument technicians, meteorologists, and parachute riggers. This list is not comprehensive. There are dozens of other occupations in the aviation field.

It should be borne in mind that the main keynote behind all this air training is *safety*. A cracked-up ship is of very little use, and a dead pilot is of no help either.

In its pilot training program the Civil Aeronautics Administration, War Training Service requires flight personnel to have a sound knowledge of the following subjects:

1. General service of Aircraft.
2. Navigation.
3. Meteorology.
4. Civil air regulations.
5. Aircraft engines.
6. Aerodynamics.
7. Structure of aircraft.
8. Radio.

How may present equipment and facilities be used to lay a foundation for the future participation of our students in the aviation field?

General Service of Aircraft

This subject is covered by Civil Aeronautics Administration Bulletin No. 23, *Civil Pilot Training*. Its main aims are to acquaint the student with the care of the plane and engine; to give him a simple explanation of aerodynamics and the theory of flight, and to familiarize him with scientific facts connected with various flight maneuvers. The subject cannot be taught well without the use of a model plane, one complete with movable controls.[1] This latter feature is more important because it enables the teacher to demonstrate the movement of controls in the various flight maneuvers. Such a model could easily be made in the school shops by preflight students. During the whole period of preflight training the students should make frequent trips to an airport to give them the necessary background for these new subjects. A mimeographed copy of the inspection check list[2] should be made and each student required to make a line inspection during one of these trips. Students in the drafting room can learn much in laying out wing profiles of chosen wing sections to a convenient scale.[3] Several wing sections should be laid out. These may be used as paper templates in cutting out profiles in plywood or cardboard. Such are very useful in demonstrating aerodynamic theories. Some profiles

*Aviation Instructor, Western Michigan College, Kalamazoo, Mich.; also private pilot; C.A.A. certified ground instructor, with ratings in navigation, meteorology, aircraft engines, aerodynamics, structure of aircraft, instruments, radio, Civil Air Regulations, and parachutes. Group training and operations officer, Group 636, Civil Air Patrol.

[1]See pp. 101–102, C.P.T. Manual, Second Edition.
[2]End of Chapter II, C.P.T. Manual, Second Edition.
[3]See *Aircraft Maintenance* by Brimm and Boggess, p. 5.

Aircraft engine assembly and disassembly. Loaned air corps equipment

Airplane blueprint reading. Airplane drafting

may be made with hinged flaps and slots to demonstrate the construction and use of these high-lift devices. Throughout all subjects in preflight training the school shops have ample opportunity for interesting and instructive work in constructing demonstration and other apparatus.

Navigation

There seems to be a general movement on foot to use the word *avigation* as meaning "navigation applied to aviation." In my opinion, this subject may be listed as one of the most important in the field of preflight training. A pilot who cannot find his way from one point to another in the air is a danger both to himself and others in his care. Avigation involves a basic knowledge of the geography of the country over which the plane must fly. It includes the use of flight instruments, maps, charts, radio, computers, and on long overland or overseas flights the use of star charts, air almanac, and a sextant or octant.

As introduction to this subject a student may be required to make maps, to lay out map projections, and to familiarize himself with the various symbols used on air maps, especially those on Lambert projections. Following an acquaintance with these maps, the student should plot a journey of about 200 miles from airport to airport. A straight line drawn between departure and destination is the *track* he may follow.

Much confusion still exists regarding the exact meaning of various avigational terms, and during this period of preflight training is the time to clear this up. Use the N.A.C.A. *Nomenclature of Aeronautics* (see reference list) and stick to the exact definitions found there. After reading various texts and references, a student is likely to be confused in his thinking or visualization of the terms *track, course,* and *heading*. In some texts *compass heading* may be referred to as *corrected compass course*. Texts used in England use the term *course* which we in our texts call a *heading*. This confusion of terms may be traced to international usage and in some part to the transition from navigation to avigation.

"Cracked up" planes and a sailplane bought by the school and rebuilt by the students

After scanning the proposed track and spotting hazards, landmarks, and possible emergency landing fields, the student will familiarize himself with the terrain over which he proposes to fly. He may then fill out an avigation schedule, reproduced in Figure 1 of this article. This will acquaint him with such terms as *deviation* and *variation*. Here again some confusion of terms is likely to appear. *Variation* in avigation is defined as "the angular difference between the true and the magnetic meridians." This in physics books is termed *declination*, and in some texts *deviation*. The term *deviation* in avigation refers to "the difference between the magnetic and the compass meridians" and is a compass error due to masses of ferrous metal and magnetic fields in the airplane itself. *Deviation* may be used in some texts to mean the same as *variation*. The teacher should give this confusion of terms special attention and clear up any misconception in the student's mind. If possible, ask local pilots or other airmen to give talks to the class to relate their experiences in the field of avigation.

There are four methods of avigation, all of which are more or less related and of which at least two should be used at the same time. They are:

1. Piloting.
2. Dead (short for deduced) reckoning.
3. Radio.
4. Celestial.

Dead reckoning is the basic method, and the others are used when occasion arises. This should therefore be more stressed than the others in preflight study. However, if any students show more than the usual amount of interest in any of the other methods, they should be encouraged to continue the work. A navigator should be an expert in all four methods.

Aeronautical Meteorology

Another *must* in the airman's list of required subjects. Often called the driest subject in aviation, it can by skillful and interesting teaching, be made fascinating and practical. It, like all other subjects in the aviation field, must be taught from the standpoint of *safety*. Many pilots, who probably had this as a classroom subject, have failed to recognize a *cold front* when they saw one or have disregarded classroom warnings regarding nature's wild moods, and many of these paid for their ignorance with their lives and the lives of others. No sensible airman would venture inside a cumulo-nimbus cloud. Some not so sen-

AVIGATOR'S PROCEDURE SHEET

Track		Distance	Altitude	Wind		Cruising Speed	Wind Correction Angle	True Course (T.C.)	True Heading (T.H.)	Variation (Var.)	Magnetic Heading (M.H.)	Deviation (Dev.)	Compass Heading (C.H.)	Ground Speed	Time of Departure		Estimated Time of Arrival (E.T.A.)	
From	To	Miles	Ft.	From	m.p.h.	m.p.h.	Degrees	Degrees	Degrees	Degrees	Degrees	Degrees	Degrees	m.p.h.	Hrs.	Min.	Hrs.	Min.
Kalamazoo	Lansing	60	2000	315°	30	95	∠ 14	55	41	2W	43	2W	45	104	10	20	10	55

Fig. 1. Avigator's procedure sheet

The above specimen avigator's procedure sheet is made out for a trip from Kalamazoo, Mich., to Lansing, Mich. A straight line is drawn on the chart (Milwaukee section), and the distance estimated. An estimate is then made of the velocity and direction of the wind. Knowing the cruising speed of the plane, an estimate is then made of the ground speed. This may be done graphically or by computer. The wind correction angle is also determined at the same time. The true course is found by using a protractor on the chart, and by adding or subtracting the wind correction angle the true heading is calculated. Variation is also obtained from the "lines of variation" on the chart and is added or subtracted from the true heading to find the magnetic heading. Deviation for that heading is found on the deviation card near the compass and with that the compass heading is obtained. The figure thus found is the number of degrees which the pilot must keep behind the lubber line on the compass in order to "make the track good"; that is, to keep the plane on the intended track from the point of departure to the destination. Knowing the time of departure, the distance, and the ground speed of the plane, the E.T.A. is quickly computed.

sible have done so, but few have returned to relate their experiences.

Aeronautical meteorology is essentially applied physics and should be taught using the apparatus found in the average high school physics department. It should be borne in mind that we are not training students to be weather forecasters. They should be able to read a weather map, to understand meteorological terms and symbols, recognize the various types of clouds in the sky, and know the type of weather or future weather they indicate.

Old weather maps are still available from the United States Department of Commerce, Weather Bureau, Washington, D. C., and a sequence of these should be used to show the general movement of air masses and other creators of weather in the country.

Civil Air Regulations

The fact that present-day flying is a *safe* method of transportation may be credited to C.A.R. Carefully formulated and rigidly enforced, the Civil Air Regulations have rescued flying from the devil-may-care chaos of earlier days and brought in safe and sane methods of flying. If one feels the urge to engage in acrobatics, one may do so providing he wears a parachute, will climb to a reasonable and specified altitude and then be sure that he has clear space below and around him. The ship has been efficiently and periodically inspected by qualified mechanics, thanks to C.A.R., and the pilot's health and eyesight certified as O.K. In short, C.A.R. provides the guiding helpful hand leading us into a new era and helping a growing industry to maturity with as few growing pains as possible.

Do not teach C.A.R. as a collection of rules to memorize. Instead show that they are nothing but good common sense. One way to do this is to have the students plan a journey by plane beginning with the warming up of the motor, taxiing to the take-off point, taking off, leaving the airport, preparing to land at the destination, and then finally stopping the motor at that place. Inject some humor into the subject by illustrations on the bulletin board such as are used by the Navy in their Dilbert series. Dilbert is classified as "an accident looking for a place to happen." Here is a good job for the art department. See what humorous simple cartoons they can invent to illustrate the wrong ways of flying.

Use humorous tests. Here is a sample of one the author uses in his classes:

Aviation Ground School *Sheet No. 21*
Subject: Civil Air Regulations
Topics: Air Traffic Rules
Problems:

I. Make a list of the violations of the C.A.R. noted in the following flight report:

* * *

Report of a flight from Jonesville to Smithville and return.
Pilot — James Jimson
Passenger — Sally Slapapple
Student pilot license No. 243S — 10 hours solo.

* * *

I took the ship out of the hangar at 7:30 p.m. and asked my passenger to sit in the cockpit. Then I went to swing the propeller. The motor started and I rushed to get into the ship in time to prevent it running into the hangar. I taxied down the left side of the runway and after swinging into the wind took off. The sun made a beautiful picture as it was setting in the west.

A small ship, which was landing at the time, zoomed over us as we left the ground. We circled the airport in a clockwise direction at about 100 feet altitude then headed 330 deg. toward Smithville, maintaining an average altitude of 400 feet during the entire trip. This was because of the 500-ft. ceiling. As we were approaching Zineville we overtook a Funk and banked to the left to avoid him, passing him on the left side at about 100 ft. We passed over a farm near the above town and my passenger dropped a note to her parents who live there to tell them she would be home for breakfast the next morning. I circled the place at about 100-ft. altitude and made a few 75 deg. banks to attract their attention.

I approached the Smithville airport at about 8:30 p.m. and flew over it at about 200-ft. altitude, then made a 70 deg. bank over the west boundary and slipped into a landing in front of the east hangar.

The weather report stated a *N* minimum at Smithville but I had an important dinner engagement so I decided to return. The return trip was uneventful but when approaching the Jonesville airport I saw the navigation lights of another ship approaching me. I banked to the left and he banked to the right forcing me to put the ship into a steep dive. On account of the low altitude I hit a tree and made a forced landing in a swamp. I expect to be out of the hospital in two months. This was my passenger's first and last flight.

Respectfully submitted,
J. H. Jones

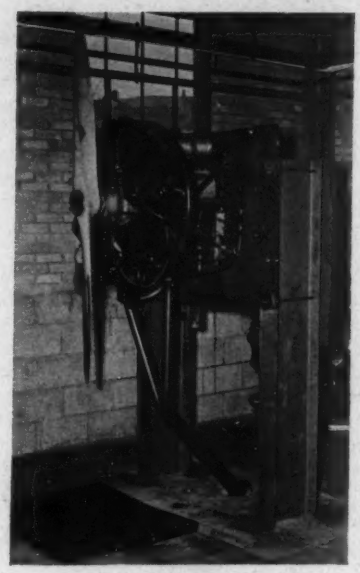
* * *

C.A.R. are changing from time to time, and such changes are printed in *Civil Aeronautic's* journal published monthly by the Civil Aeronautics authority. These magazines should be kept on the current list of the school library and all changes noted.

Aircraft Engines

To this subject our automobile mechanics classes should be easily adapted. An aircraft engine is a refined automobile engine with changes made to meet different conditions. Reliability is the major keynote with low weight and efficiency combined.

From time to time worn-out or obsolete engines and equipment are released by the Army Air Corps and Naval Air Service for the use of schools. These may be used as demonstration equipment or in teaching nomenclature and assembly in the school shops. When possible a *live* engine should be mounted on a test stand (see illustration) and after being carefully screened to prevent accidents, used in trouble shooting



Radial engine from "cracked up" plane rebuilt and used for test and trouble shooting

and maintenance work. A portable test stand may be constructed from a Model T chasis. This makes it possible to wheel an engine outside the shops and test it under better operating conditions. No text or reference book on this subject can be more highly recommended than C.A.A. Bulletin No. 28, *Pilot's Power Plant Manual*, L. E. Shedenlen.

Aerodynamics

This will probably be taught as a senior subject in high school. It demands special equipment from the school lab, a greater part of which can be made in the school shops. It is not beyond the skill and the tools usually found in the high school woodshop to construct a wind tunnel for the demonstration testing of wing sections and solid wood models used for such testing in the larger wind tunnels seen in the Aeronautical Engineering Departments of our universities and colleges. As a suitable laboratory manual using school-made apparatus I can recommend *Elementary Laboratory Aerodynamics* by Arthur L. Jordan, Ronald Press Company, New

York. This book contains sketches and descriptions of home-made apparatus. For construction of a wind tunnel, see N.A.C.A. report No. 195, *Standardization Tests of N.A.C.A. No. 1 Wind Tunnel.* On page 41, C.A.A. Bulletin No. 30, *Ground Instructors Manual* will be found a description of simple apparatus for use in demonstrating *lift* and *drag*. This can be constructed very easily in the school shops.

Structure of Aircraft

This is essentially a shop subject including woodwork, machine metalwork, fabric, welding, drafting, and machine shop. The shop processes involved are governed very strictly by specifications laid down in C.A.A. Manual No. 18, and all shopwork should be guided accordingly. Several excellent texts are available in airplane drafting, although fundamentally drafting room procedure in aviation is the same in any other engineering field. C.A.A. Bulletin No. 27, *Pilot's Airplane Manual* provides excellent reference material.

Although it may be impossible and impracticable to build an airplane in the school shops, there should be no impassable barriers in the way of an enthusiastic shop instructor and some equally enthusiastic students if they wish to build a scale model of an actual plane. The author's experience in this regard in the depth of our prewar depression may serve to illustrate such a procedure. Six students in an auto-mechanics class were so intensely interested in aviation that the author finally decided to allow them to build a scale model of an airplane. The six agreed to build a quarter-scale Lincoln Sport plane. A description of this plane was obtained from a magazine, and the work began.

The boys laid out the wing section in the drafting room and made a template from which a rib jig was constructed. Sufficient wood was obtained from the woodshop to construct the ribs and the spars, the longerons and the struts of the fuselage, and the fairing. Sheet metal was not available for fittings, so the boys cut up fruit cans obtained from the cafeteria. Used bailing wire was brought from the farm of one of the boy's parents and used as bracing wire. A dummy motor was carved from wood, and a propeller carved to correct scale and pitch from drawings made in the drafting room. This propeller was carved in its entirety from a piece of 2 by 4. All work was done exactly to scale and the boys worked for part of the time during the early spring in an unheated storeroom because of lack of space in the auto shop.

As the project neared completion it created a considerable amount of interest among the other students and sufficient money was donated by the school to pay for fabric covering. All six boys finally entered the aviation field. Three are now Army Flight Instructors, one holds an executive position in the aviation world, one I cannot trace, and one died while experimenting as a pioneer in a new branch of aviation.

Such projects bring great dividends not only in satisfaction to the student and teacher but, as it so happened, in helping this country to maintain civilization in a world beset by pagans. References suitable for school shopwork are given at the end of this article. An excellent text for aviation work in the school shop is No. 1 B in the reference list, *Aircraft Maintenance* by Brimm and Boggess.

Radio

This is an essential part of aviation training, especially in avigation, and it should be taught as an aid to this branch. The use of radio should be stressed, sufficient theory being given to enable the airmen to realize the part played by the various units in his equipment. Drawings may be made to illustrate radio range beacons and sufficient speed in radio code should be attained by the student so that as future pilot or navigator, he may recognize the quadrant signals and the identification letters of stations. A speed of six words per minute in straight text should be attained, because it often happens in cases of emergency, that code will get through when radio telephone is probably drowned out by static or other interference. Many good radio oscillators for teaching code may be found illustrated in radio magazines, and one of these can be made by the students of the radio club or electricity class. The following illustration shows one used in the author's classes.

In building this oscillator for code practice, and also in carrying out other radio projects in this preflight training, it may be that difficulty will be experienced in obtaining radio parts. It is suggested that an appeal be made through local newspaper advertising for old radios to be dismantled and the parts used for these projects. You will be surprised how many usable parts can be obtained in this way. In teaching code be sure that it is taught by sound only or by blinker light. Code, like any other subject, should be taught as it is used. Too many students have visualized *a* as a dot and a dash, when it should be remembered as an auditory dit–dah.

Conclusion

Before and during the process of *air conditioning* the students in our public schools, a great deal more might be done to air condition our teachers. One cannot do a good job in teaching aviation subjects unless the teacher himself or herself is enthused with the spirit of aviation. This can be acquired by visiting airports and factories where planes are flown and made, by reading aviation magazines, and by talking to people engaged in those fields. Above all, when humanly possible the teacher of aviation subjects should learn to fly.

Until one has had the pleasure and thrill of driving these winged steeds, an aviation subject may seem like just another subject in the school curriculum. After the first few flying lessons and after the first few weeks of teaching this new subject, join an organization such as the Civil Air Patrol or a Flying Club. There are many teachers in our schools today who could make a worth-while contribution of their knowledge and special skills to such organizations. Once a member of such a body, men and women teachers will feel that they have become a part of aviation, and students will realize that the aviation being

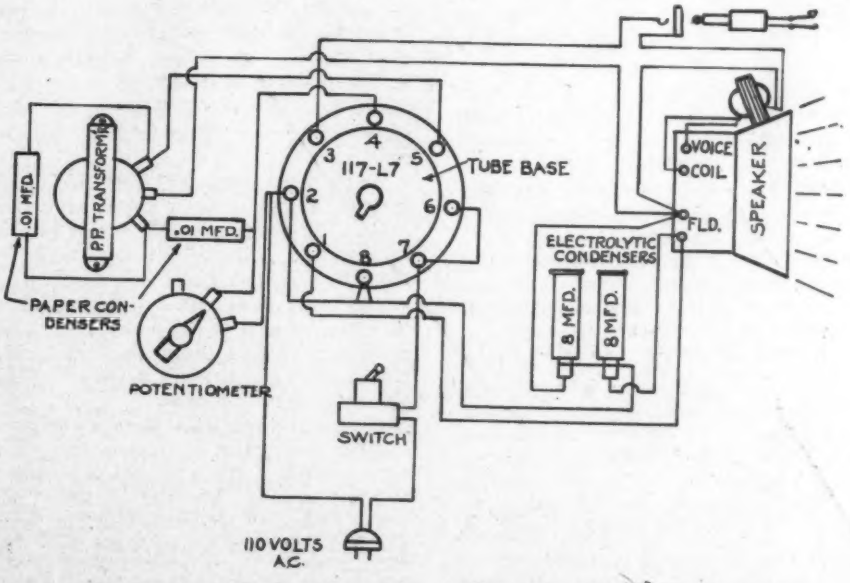


Fig. 2. Diagram of one-tube audio oscillator showing wiring to parts

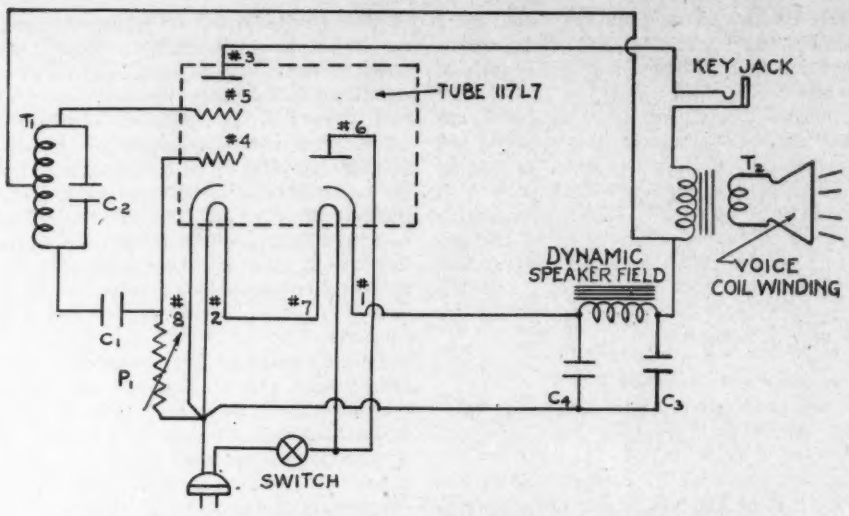


Fig. 3. Circuit diagram of one-tube audio oscillator suitable for code practice in a classroom seating 30 or 40 students.

T_1 Primary of push-pull output transformer with core removed; T_2 speaker coils; C_1 — .01 mfd tubular paper condenser; C_2 — .01 mfd tubular paper condenser; C_3 — 8 mfd electrolytic condenser; C_4 — 8 mfd electrolytic condenser; P_1 — 200 M Ω potentiometer

taught is not just being read from a textbook but is part of the teacher's own hobby and experiences.

Here is one final criticism which I must make concerning our preflight training. We are placing far too much emphasis on the preparation of flight crews, forgetting the fact previously mentioned that it takes at least 15 men on the ground to keep one man in the air. Why not emphasize also preaviation ground school training for those who will "Keep 'em Flying."

References

The letter at the beginning of each division of the subject will be found at the end of each reference containing useful material for this branch.

A. General Service of Aircraft.
B. Navigation.
C. Meteorology.
D. Civil Air Regulations.
E. Aircraft Engines.
F. Aerodynamics.
G. Structure of Aircraft.
H. Radio.

1. A. *Aircraft Engine Maintenance.*
B. *Aircraft Maintenance.*
Books by Brimm and Boggess. Putman Publishing Company, New York. *Aircraft Maintenance* is an excellent shop manual written on a job sheet basis.
2. *General Aeronautics* by Hilton B. Lusk. Ronald Press Company, New York City. A general all around text highly recommended for any high school course in aviation.
A, B, C, D, E, F, G, H.
3. C.A.A. Bulletins.
No. 22 *Digest of Civil Air Regulations.* D
No. 23 *Civil Pilot Training Manual.* A, B
No. 24 *Practical Air Navigation.* B
No. 25 *Meteorology for Pilots.* C
No. 26 *Aerodynamics.* F
No. 27 *Pilot's Airplane Manual.* G
No. 28 *Pilot's Powerplant Manual.* E
No. 29 *Pilot's Radio Manual.* H
No. 30 *Ground Instructor's Manual.* A, B, C, D, E, F, G, H

These government bulletins are excellent and inexpensive reference material. Nos. 22–25 inclusive are used in the C.A.A. Elementary Pilot Training Program. Nos. 26–29 in the Advanced P.T.P. These books were formerly used in the Civilian Pilot Training Program, now known as the C.A.A. War Training Service. An excellent series of study guides, which should be in the hands of all teachers using these government bulletins, has been prepared by instructors at Stockton Junior College, Stockton, Calif. Write to "The C.P.T. Study Guide Publishing Company," Stockton, Calif.
4. *Radio, A Study of First Principles* by Elmer E. Burns. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York City. H
The Radio Amateur's Handbook, Special Defense Edition. American Radio Relay League, Hartford, Conn. H
5. An excellent series of aviation texts is published by the Thompson Aviation Publishers, Detroit, Michigan.
No. 1 *A Practical Study of the Airplane.* A, F, G
No. 2 *Practical Aerodynamics.* B
No. 3 *Practical Air Navigation.* B
No. 4 *Practical Meteorology.* C
6. *National Advisory Committee for Aeronautics.*
Nomenclature for Aeronautics, A, B, C, D, E, F, G, H. Latest Edition.
7. Periodicals.
A. *Flying and Popular Aviation.* Monthly. Ziff-Davis Publishing Company, 606 South Dearborn Street, Chicago, Ill.
B. *Aero Digest.* Monthly. Aeronautical Digest Publishing Corporation, 515 Madison Avenue, New York City.
C. *Aeronautics Weekly.* National Aeronautics Council, Inc., 37 West 47th Street, New York.
D. *Civil Aeronautics Journal.* Monthly. Civil Aeronautics Administration, Washington, D. C.

WOMEN IN THE SCHOOL SHOPS

H. J. SHUFELT*

Racine, Wis., is an industrial city and consequently it is well tied up with the war effort. Recognizing the increasing employment of women in defense industries, the Racine school system decided to see what might best be offered girls in the high school to prepare them for this type of employment.

Employment managers and officials of various key industries in Racine were consulted. These men were happy and anxious to cooperate. A list of comments made by them were compiled and presented to the school board along with a suggested course of study for girls in the industrial-arts department. This has been accepted by the school board and is to be incorporated into the curriculum immediately.

Representatives from the following industries contributed to this material: J. I. Case Company; Hamilton Beach Manufacturing Company; Webster Electric Company; Belle City Malleable Iron Company; Chicago Rubber Clothing Company; Dumore Electric Company; and Western Printing and Lithographing Company.

*Supervisor, Industrial Arts, Racine, Wis.

Comments By Industrial Representatives on What to Teach Girls in Industrial Arts

1. It is desirable to combine statements of all industrialists and send them a copy. A meeting should then be called to discuss content of what girls should be taught.

2. Blueprint reading should be taught in connection with the work in hand, not as a separate course.

3. Some industries will be glad to furnish machine parts with blueprints so that girls may learn to read and become familiar with blueprints.

4. Some industries will gladly furnish speakers from time to time to lecture on certain phases of industry.

5. Work in industry is very specialized. This course cannot attempt to instruct the student to become skillful in the exact job she will enter in industry. It can, however, familiarize her with what industry expects in other matters.

6. Teach the student what is meant by tolerances and why we have them.
7. Teach the student co-ordination of hand, brain, eye, and ear.
8. Teach the student how to count and use hands at the same time.
9. Girls are better on repetitive work than boys. They should be taught to assemble parts rapidly and accurately.
10. Train girls so that they are not frightened when they enter industry. This may be done by teaching them to operate and learn the names of parts of various machines.
11. Teach girls to ask questions if they do not understand what is expected of them. This will save time and materials.
12. Teach them the sequence of operations so that they will feel the importance of the job they are doing in contributing to the production effort.
13. Teach the girls what is expected from them in the way of conduct in the plant.
14. Teach them to respect themselves and to respect the orders given them by their foreman.
15. Teach them the importance of not encouraging remarks that are off-color.
16. Have a good nurse who understands industrial life talk to the girls, teaching self-respect, health, good habits, proper clothing, and right living.
17. Teach girls their importance in industrial life as a part of the production program.
18. Teach them that they are going to work with older and more experienced people; that they should take advice from these people.
19. Teach them that they are going to enter industry where production is the main objective.
20. Teach safety as it relates to all industrial life.
21. Teach neatness, promptness, accuracy, cooperation, and consideration of others.
22. Teach production in industry through the showing of motion pictures and slides.
23. Teach girls to analyze their job.
24. Teach care of equipment.
25. Teach reading of simple blueprints in connection with inspection.
26. Teach girls simple fractions and decimals.
27. It is suggested that this work be taught in the electrical and machine shops.

Skeleton Course of Study

Name of course: Industrial Machine Shop
Time: Saturday mornings, 8:00 to 12:00
Object of course: An orientation course to acquaint young women with type activities they will encounter in local war industries.
Methods of instruction:
1. Lecture.
2. Demonstrations.
3. Visual aids.
4. Individual and group shop instruction.
5. References.
6. Tests.

Course outline — activities:
1. Industrial plant layout.
2. Departments of industry.
3. Machine operation: names of parts and small tools.
4. Blueprint reading.
5. Reading of gauges, micrometer, vernier, scales, etc.
6. Inspection.
7. Assembly.

Related information:
1. Mathematics of fractions and decimals.
2. Safety — health.
3. Accuracy.
4. Production.
5. Need of women in industry.
6. How industry operates.
7. History of a casting or forging from design to finished product.
8. Origin of equipment and supplies.
9. Need for skillful women in industry to aid the war effort.

Lectures (at least 1 hour out of every three periods):
1. Importance of women in industry.
2. Need for accuracy by workmen.
3. Importance of maintaining health efficiency.
4. Discussions on the patriotic spirit.
5. Industry's part in war production.
6. How production is organized.
7. Safety and its relation to war production.
8. Cooperation with other workers.
9. Right living as a means of aiding production.

A similar course in industrial electricity is being worked out.

A Technique for the War-Production Training Program

S. JOE WILLIAMS*

One of the most striking characteristics in the philosophy of the war-production training program is its almost utter disregard for the personal factor in its training. This attitude is at distinct variance with the best thought of the older and more conservative ideas of educations both academic and vocational. In our elementary schools we educate the child ostensibly for the good he may do to society. In reality we hope to benefit society while we save the child. In high school the same truth is still more apparent. Even in the vocational schools where the courses of study are made with a vigilant eye on industry and its needs, we never lose sight of the individual as a personality. The war-production training program thinks less and less of the individual and more and more of the war-production industry in which the trainee may be placed. The emphasis becomes not so much what can we do for the trainee to advance him in his trade as how good a workman can we make and in how short a time for the advancement of the war industry in which his services are most needed.

Nor is this the only place in which the philosophy of the new school differs from that of the ordinary trade school with which it can be most easily compared. In most trade schools there is some integrating and some broadening learning. In the war-production training program there is none. The latter program seeks to eliminate every waste motion and every waste moment. In the first type of school there is a comparatively long training period with varied experiences. In the second type, short courses with specialized intensity are favored. Since in the one we are training youth, its philosophy adapts itself to that age. Just so in the other, the philosophy adapts itself to adulthood and maturity.

The new program differs from the old in objectives as well as in philosophy. In the former established vocational education emphasis is placed on a broader training aimed at making an eventual skilled workman in all branches of his trade. The newer training gives short intense units of training aimed at skill in a particular operation of the trade or at most skill in the operation of one particular machine of the trade. In our regular vocational schools we wish to turn out a graduate who is at least an upper-level apprentice in his chosen vocation. The new program is not even interested in apprenticeship. The

*Public Schools, Kansas City, Mo.

older program wishes to enrich the skills of the trainee with a maximum of pertinent information about the trade. The newer program wishes a maximum of skill in the shortest time with regard for only the essentials of related information. It is incorrect to refer to the new program as training for a trade as that term has always been used. It is training in operations, training for war effort, training for America's salvation.

Along with the new and strange philosophy and the queer and unorthodox objectives the war-production program has developed a new, yet old set of techniques. New in that they take an unusual set; old in that they are rooted in the same established beliefs that have always actuated vocational education. The child shares the father's social inheritance. No form of training whether for industry or for whatever else can ever stray very far from the lights which have guided education through the past. The following may be given as a sample of these fundamentals: each course must have a carefully organized outline; there must be a definite method, as nearly objective as possible, for testing and measuring the skills and progress of the trainee; there must be some means of preserving and recording the results of these tests; and there must be a means of keeping the trainee advised of his progress. In addition to these the new program adds the clear obligation of reporting the skills and abilities of the trainee to prospective war industries who might need his service. These are familiar promises. They do not sound new nor are they. Perhaps the new techniques are not new at all. Most of them would apply as well to the older program as to the newer. The significant thing is that it has fallen to the new program to use them more extensively. There is a tendency to identify the suit with the wearer even though any good man might wear it with distinction.

And so the thing that is being offered here is probably misnamed when it is called a new technique. It is in reality a new application of an old technique. Still a better way to put it is that it is but a sample of a new machinery doing an old job. The cards and sheets presented represent an attempt on the part of one unit of the war-production program to solve the difficulties of the new philosophies in attaining the new objectives. These cards and sheets are not perfect. Far from it. Perfection is not attained in 18 months. They may not even be acceptable to most people. They certainly are not original in their entirety. Educational ideas seldom are. At very least they will serve as feeble and unsteady steppingstones to a broader and better path of improved techniques.

Figure 1 shows a typical course card. Each trade has been broken down into the several component parts, each of these

War-Production Training Program, Kansas City, Mo.

Name of Trainee..... Age.....

The instructor will initial each skill or knowledge when it has been satisfactorily mastered.

Lathe Operation

.... 1. Grinding tools for jobs indicated below
.... 2. Finding the center of stock
.... 3. Centering stock in chuck
4. Facing work
.... *a*) Between centers
.... *b*) In chuck
5. Straight turning
.... *a*) Between centers
.... *b*) In chuck
.... 6. Using an indicator
.... 7. Using micrometer
8. Turning to shoulder
.... *a*) Between centers
.... *b*) In chuck
.... *c*) With mandrel
.... 9. Knurling
10. Taper turning
.... *a*) Using tailstock
.... *b*) Using taper attachment
.... *c*) Using compound rest
.... 11. Freehand form turning
.... 12. Drilling and tapping
.... 13. Boring and reaming
.... 14. Boring to shoulder
.... 15. Taper boring
.... 16. Thread cutting external
.... 17. Thread cutting internal
.... 18. Use of steady rest
.... 19. Use of follower rest
.... 20. Reading blueprints
.... 21. Working to close tolerance at near production speed

Remarks:

Date in training.....
.....
Trainee's Signature
Date out of training.....
.....
Teacher

Fig. 1. A typical course card

parts representing a complete training unit. In the machine shop are to be found courses in lathe operation, milling-machine operation, shaper operation, and turret lathe operation. Each of these is taught as a separate entity and no attempt is made to teach any one trainee more than one of them. Thus the objective of machine tool operator rather than machinist is finding its expression. This same type of division is found in every shop and in every trade.

The course card lists the processes and skills the trainee must master. It is the road he must travel, or if you prefer to think of it this way it gives the name and number of the hills he must climb. When he climbs a hill and can look back on the incline he has surmounted, he gets his ticket of accomplishment. The instructor signs the card showing that the trainee had actually and literally *made the grade*. He has been tested. He has *mastered* or *satisfactorily completed* the skill or knowledge. He is ready to tackle another hill. Perhaps the hills are not arranged on the card in the order in which he wishes to ascend to job competence. Then he and the instructor may arrange the hills in the order best suited to him. Some trainee by past experience may have already climbed certain of the hills. Let him convince the instructor of such accomplishment and he is excused from climbing those hills again except as climbing them may be necessary to subsequent hills. It need not be said that the use and even the formulating of the course cards is evidence that a definite course for the different units has already been organized. It becomes, then, an individual effort in conformity with a prearranged schedule for the attainment of proficiency.

Figure 2 shows the master sheet that accompanies the course cards. This sheet remains in the hands of the instructor and must be checked as each skill is initialed for the trainee and, what is just as important, it must be checked at the same time the course card is initialed. The two must be always in tune with each other. Obviously the master sheet is the official record. At the close of the training period the master sheet becomes a part of the permanent record of the trainee and is on file for future reference. An exact copy of it with the identical units checked is forwarded to the employment service and to prospective employers. The units not completed are deleted from this copy.

A glance at this master sheet shows that it is made up of copies of the various course cards for a particular trade. It gives all the divisions of the trade taught. As extensions are made the master sheet will be enlarged. Entries may be made for more than one machine tool operation for, while instruction is given to a trainee on only one machine, his previous experiences may fit him for work on one or more supplementary machines. And while the trainee may

War-Production Training Program, Kansas City, Mo.

Name of Trainee..... Address..... Age.....
Race..... Social Security No.....Hrs. in Tr.....
Date in Training.....Date out of Training.....
Date of this report.....
The instructor will initial each skill or knowledge that has been successfully mastered.

Lathe Operation

.... 1. Grinding tools for the jobs following
.... 2. Finding the center of stock
.... 3. Centering stock in chuck
4. Facing work
.... *a*) Between centers
.... *b*) In chuck
5. Straight turning
.... *a*) Between centers
.... *b*) In chuck
.... 6. Using an indicator
.... 7. Using micrometer
8. Turning to shoulder
.... *a*) Between centers
.... *b*) In chuck
.... *c*) With mandrel
.... 9. Knurling
10. Taper turning
.... *a*) Using tailstock
.... *b*) Using taper attachment
.... *c*) Using compound rest
.... 11. Freehand form turning
.... 12. Drilling and tapping
.... 13. Boring and reaming
.... 14. Boring to shoulder
.... 15. Taper boring
.... 16. Thread cutting external
.... 17. Thread cutting internal
.... 18. Use of steady rest
.... 19. Use of follower rest
.... 20. Reading blueprints
.... 21. Working to close tolerance at near production speed

Milling-Machine Operation

.... 1. Use of jigs and fixtures
.... 2. Slab milling
.... 3. Sawing and slitting
4. Form milling
.... *a*) Use of formed cutters
.... *b*) Use of fly cutter
.... 5. Use of dividing head
.... 6. Angular work
.... 7. Face milling
.... 8. Milling with end mill
.... 9. Gang milling
.... 10. Drilling and boring
.... 11. Spur gear cutting
.... 12. Use of vertical attachment
.... 13. T-slot milling
.... 14. Use of angle plate
.... 15. Spiral milling
.... 16. Reading blueprints
.... 17. Working to close tolerance at near production speed

Shaper Operation

.... 1. Reading and interpreting blueprints
.... 2. Setting and reading measuring instruments including micrometers
.... 3. Use of hand tools
.... 4. Identifying and knowing the properties of common metals
.... 5. Setting up machine, regulating its speed
.... 6. Making ordinary repairs to his machine
.... 7. Working with jigs and fixtures
.... 8. Machining to irregular line or template
.... 9. Squaring up work and cutting parallels
.... 10. Doing vertical and angular cutting
.... 11. Cutting dovetails inside
.... 12. Cutting dovetails outside
.... 13. Keyway cutting external
.... 14. Keyway cutting internal
.... 15. Working to close tolerances at near commercial speed
.... 16. Sharpening tools for jobs indicated

Turret Lathe

.... 1. Drilling
.... 2. Parting
.... 3. Reaming
.... 4. Chamfering
.... 5. Tapping
.... 6. Knurling
.... 7. Hollow mill turning
.... 8. Box tool turning (single)
.... 9. Box tool turning (multiple)
.... 10. Threading, solid die
.... 11. Threading, self opening die
.... 12. Boring
.... 13. Internal threading
.... 14. Blueprint reading
.... 15. Identifying metals
.... 16. Use of instruments and devices

Remarks:

.....
Teacher's Signature
.....
Supervisor

Fig. 2. The master sheet

not have a course card for the supplementary machine, the fact that he has these skills is pertinent information for the industry in which he may wish to be placed.

In an earlier paragraph certain fundamental axioms were stated as basic in any training program. It may be well to see how the course cards and master sheet provide for these fundamentals. First, each course has a definite outline. This is evidenced by the fact that there is a course card and a master sheet. Second, there is provision for testing and grading the trainee. His course card will show that. Third, the master sheet provides the means of recording and preserving the results of these tests. Fourth, the skills and abilities of the trainee have been reported to prospective employers. This leaves only the matter of a record of the trainee's progress in his course.

There seems to be two schools of thought even among war-production trainers in the matter of progress evidence. One group holds to the wall chart method. On the wall progress chart the names of all trainees are listed together with the number and names of the units each has completed. The time consumed on each job is also usually indicated. The other group favors an individual progress chart. Each system has its advantages. The choice is a matter of personal opinion of the user. It is significant that basically the groups are in concurrence. Both insist that the record must be current and specific. Both insist that the trainee must be given free access to his record. And, in the final analysis, the success of either method depends largely on the instructor and the trainees under his charge. The best car in the world is useless without a driver who works at the job. Either method may be made or broken by the manner in which it is driven.

It would seem that the best argument for the wall progress chart is that it stimulates competition and permits a trainee to compare his record with that of other trainees. This argument is well founded. This type of record capitalizes a great American characteristic, the competitive spirit. It gives the trainee a chance to race with his fellows. It is a natural utilization of a natural desire. The only question is whether or not it is the best way for war-production trainees. It is undoubtedly very effective when used in the day-trade school. There the pupils all start at the same time and at practically the same level. They all have certain learning units to master and the time limit for these jobs is usually the school term. They all have the same jobs in the same time. When all are running the same race at the same time group competition is natural and essential. But the situation is far different in the new program. The trainees do not enroll in the class at the same time. They cannot be compared on the basis of concurrent time in training. Each has a vastly different previous experience. While two or more may be doing the same job at the same time, each may be doing that job at a different level. For some it may be the first experience of the kind. For others it is a refreshing of a long neglected art. They cannot be compared on the basis of the same job. Their only common ground is that they happen to be in the same shop at the same time and they happen to be headed for perhaps the same industry. When each is running a different race at a different time and at a different tempo competition is impossible.

Unlike the day-trade pupils the war-production trainees do not even have a social community. There is no way to stimulate competition between an ex-sales-

man who in reality is having his first meaningful experiences in the machine shop and a grizzled veteran of many years of machine-shop work who is only now refreshing his trade after some years of absences. The only competition possible in such a group is the competition of each individual with himself. To use the terms of a golfer, his best competition is shooting against par, not shooting against an opponent. Give this man a course outline and dangle before him a *job at completion* and he is not interested in the progress of the trainee next to him. His only thought is "how quickly can I get it?" His course card tells him how quickly he *is* getting it. The course card thereby becomes the progress record. It also serves still another purpose not previously mentioned. It is the trainee's service record when he leaves. It has a threefold mission: course outline; progress chart; and service record.

The two forms shown are only a small part of the machinery required for the efficient operation of a war-production training unit. In the field of trainee accounting alone there are many other things to be considered. Attendance must be carefully recorded and reported. There are various forms from the office of education and from the state departments to be mastered and filed. There are the statistical reports; reports of placements; the VE-ND 1 forms to be filled out and filed and a multitude of other detail. In the field of trainee accounting alone an enormous amount of material has already been produced, most of it good; some of it excellent. A mighty task still is waiting in the matter of teaching materials and course development though here too some outstanding things have already been accomplished. The material shown constitutes a sample of the kind of work being done and it demonstrates the type of work still to be done. May other and more proficient hands carry on to more improved techniques and greater accomplishments.

THE WINNING WAY

Oh, you just can't make much headway,
When your heart's not in the task;
Expecting easy victory,
Is much too much to ask.
You've really got to knuckle down
And try with all your might,
For victory has ne'er been won,
Without an honest fight.

So put your shoulder to the wheel,
And push with all you've got,
You'll find the wheel moves easy,
When there's "will" instead of "not"
For all the things you planned for,
Are at the end of the road,
And looking back, you'll smile and say;
"It wasn't so heavy a load."

— *Leonard E. Schmidt*, Lincoln Hall Vocational Shops, Lincolndale, N. Y.

Drafting for Girls

LOUIS BAROCCI*

The girls' drafting class was started at Cudahy High School in September, 1942. It was at the suggestions of local war-production industry, school administrators, and industrial-arts teachers, that the class was organized and offered to junior and senior girls during the advisory period.

The girls will have experiences in the following fundamentals of mechanical drawing:

1. Lettering
2. Use of instruments and drafting equipment
3. Alphabet of lines
4. Dimensioning
5. Geometric constructions
6. Orthographic projection
7. Freehand sketching
8. Scale drawing
9. Inking
10. Tracing
11. Blueprinting
12. Blueprint reading

Textbooks for the first semester course: General Mechanical Drawing by McGee and Sturtevant.

The girls are required to turn in the following plates from the McGee text.

1. Lettering plate
2. Plate 1B
3. Plate 2A
4. Page 19
5. Plate 4B
6. Plate 5A
7. Plate 12A — (Freehand sketch)
8. Plate 13A — (Freehand sketch)
9. Plate 14A
10. Plate 14B
11. Plate 1CA
12. Plate 1CB
13. Plate 18B
14. Pages 74 and 75 (Geometric construction)

The students will be required to hand in lettering cards several times a week until such time when, in the judgment of the instructor, they will seem sufficiently proficient in lettering.

*High School, Cudahy, Wis.

Inking: Use of ink and inking instruments. Plates 1B, 2A, 14A, 14B, 16B.

Tracing: Trace with ink on tracing cloth or tracing paper the following plates: plates 1B, 2A, 14A, 14B, 16B.

Near the end of the course, each girl will design a simple cover to hold all her drawing plates.

Order of Penciling

1. Balance views on sheet.
2. Draw center lines.
3. Work out views simultaneously with light lines.
4. Check layout.
5. Clean drawing and remove the superfluous lines.
6. Redraw result lines, visible and invisible, making them of finished drawing weight.
7. Dimension and odd notes.
8. Section cut surfaces.
9. Check the drawing.
10. Add title and number.

Order of Inking

1. Trace visible circles, arcs, and irregular curves.
2. Trace horizontal visible lines.
3. Trace vertical visible lines.
4. Trace slanting visible lines.

5–6–7–8. Trace invisible lines in the above order (1, 2, 3, 4).

9. Trace center, extension, and dimension lines.
10. Trace arrowheads and dimensions.
11. Section line cut surfaces.
12. Letter notes, title, and plate number.
13. Check the tracing or inking.

Course Content — Second Semester

Mechanical Drawing 11 — use 11 by 15-in. paper.

Texts — 1. *Mechanical Drawing Problems* by Berg and Kronquist. 2. *General Mechanical Drawing* by McGee and Sturtevant.

Course Content — Lettering, developments, auxiliary views, inter-sections, order of inking, tracing, blueprinting, blueprint reading, graphic data, structural steel, and isometric.

Girls' drafting class, High School, Cudahy, Wis.

A War-Training Machine Shop

G. H. PARKES[1]

The new machine shop training unit, known locally as "Unit No. 4" of the Williamsport Technical Institute, was designed and built during the war-training emergency and for war-training purposes. The chief characteristic of this building is its large machine floor, 15,700 square feet of clear space devoted exclusively to shop stations. Another 15,400 square feet on a lower level provides all auxiliary service units for 200 machine stations.

Second Larke Machine Shop. The Williamsport Technical Institute, which is a vocational and technical school of about 1000 training stations serving a population radius of about 20 miles, is a unit of the public school system of Williamsport, Pa. The Institute has been constructing shop units of the factory type since 1931 and now has five large shop units, the largest of which contains 5700 square feet of clear shop space. In addition, the first unit of a large aviation trade school, located at the municipal airport, has been completed.

The present machine shop was designed to replace a smaller shop of about 10,000 square feet which was inadequate for the increased program made necessary by the war-training program.

A typical view of the Williamsport Technical Institute vocational machine shop with a war-production group in training

Plan and Safety Precautions

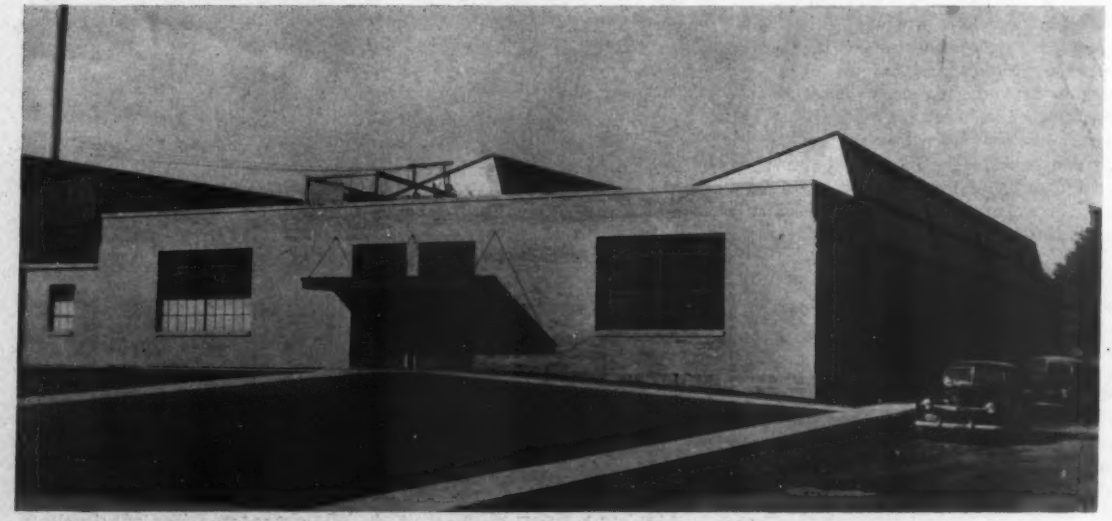
Self-Contained Unit. "Unit 4" is designed to be a self-contained school machine shop training unit based upon a close approximation of a commercial machine shop. It was constructed so that all of the valuable main floor space could be utilized for the basic training stations without the necessity for partitions or service areas. The shop is divided, but not partitioned, into units for the basic machine tools, lathes, milling machines, drill presses, toolmaking, screw machines, and other similar units. Provisions are made for the training of women, although there is some evidence at this writing that certain additional rest-room alterations must be made soon to accommodate the unexpected increase of women trainees. While students of the high school level will use the shop, the design is based entirely on the needs of adult training classes.

Air-Raid Precautions. Since about 70 per cent of the wall area is in glass, the problem of blackouts is a serious one. At present, no attempt will be made to carry on training activities on the main machine floor during total blackouts. Provisions have been made in the auxiliary space on the lower floor for blackout and splinter protection while carrying on certain related and visual instruction. In the event of total blackouts, the shop classes move to this secondary area and participate in a prearranged instructional program of a general nature.

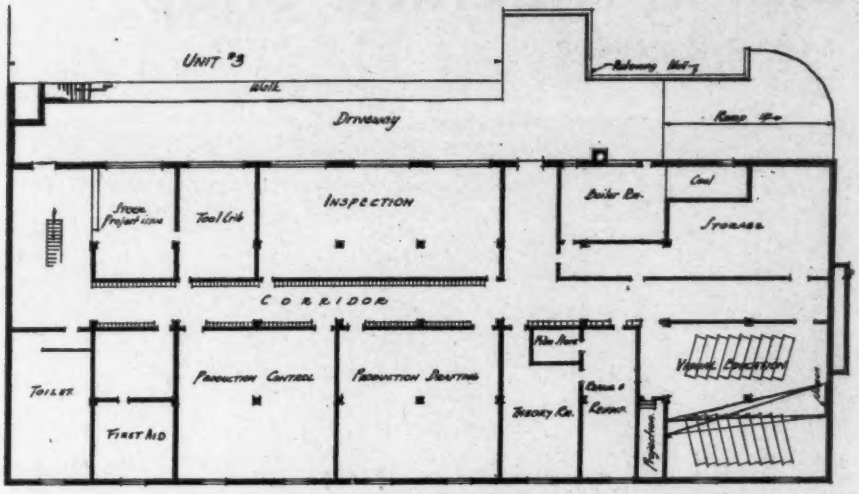
Departmental Arrangement

The Tool Crib. Tools are issued on the ground floor where most of the lockers, toilets, and other service facilities are installed. Per-

[1]Director, Williamsport Technical Institute, Williamsport, Pa.



New Machine Shop Unit, Williamsport Technical Institute, Williamsport, Pennsylvania.



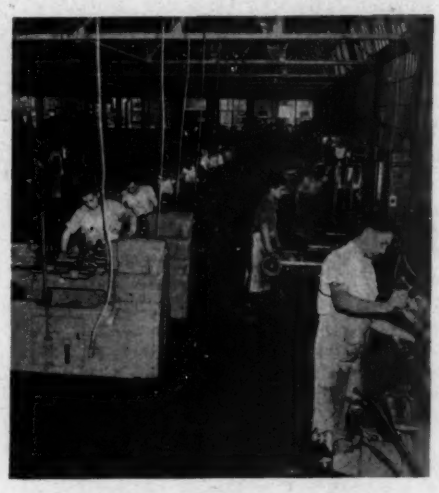
Basement Floor Plan, Unit 4, Williamsport Technical Institute, Williamsport, Pennsylvania

sonal tools are not provided by the Institute, so that this tool crib does not need to be in the shop itself. Near the toolroom is the project issue room where uncompleted projects are stored between operations. Since the shop is designed for factory type production, the care of materials in process is an important factor.

The Planning and Inspection Department. The shop works on war production as a by-product of its instruction program. The Lycoming Division of the Aviation Manufacturing Corporation, makers of radial and horizontal opposed aircraft engines, is the chief cooperating plant. Since war production is subject to close inspection, every production job taken into the school is planned in a planning department and inspected in a special precision inspection department. These departments also serve as useful training facilities for planning and inspection.

The Gauge Department. The gauge room is a part of the storeroom although it is closely associated with the inspection program. This department is responsible for the care of the hundreds of precision tools and fixtures. A constant check is kept on the accuracy of tools and instruments in this room. Since certain products must be held to a manufacturing tolerance of two tenths on diameters and two micre-inches on finish, those familiar with precision instruments will recognize the need for the gauge room.

The Projection Room. The projection room is an outgrowth of the excellent film instruction material prepared by the United States Office of Education for war training. The new machine shop uses these films as a definite and scheduled unit in machine-shop training with the knowledge that certain skills can be taught more efficiently thus than through actual practice. A full-time visual education expert is a member of the machine shop staff. As noted above in the paragraph on blackouts, this room serves as a combined air-raid shelter and projection room during blackout periods. A large related theory room near by provides for other related instruction.



This group is in training for war production tool-room service

Construction and Cost

Construction Data. The building is steel framed with glass and brick curtain walls. The sawtooth roof is skylighted through special monitors, and the roof is 2-inch plank, with built-up roofing. The main floor is of maple over a subfloor with reinforced concrete slab and columns below. The floor slab is designed for 150 pounds per square foot. The ground floor is of concrete. Artificial lighting is of the continuous row fluorescent type with about 50 foot-candles intensity. The power system is of the bus bar type.

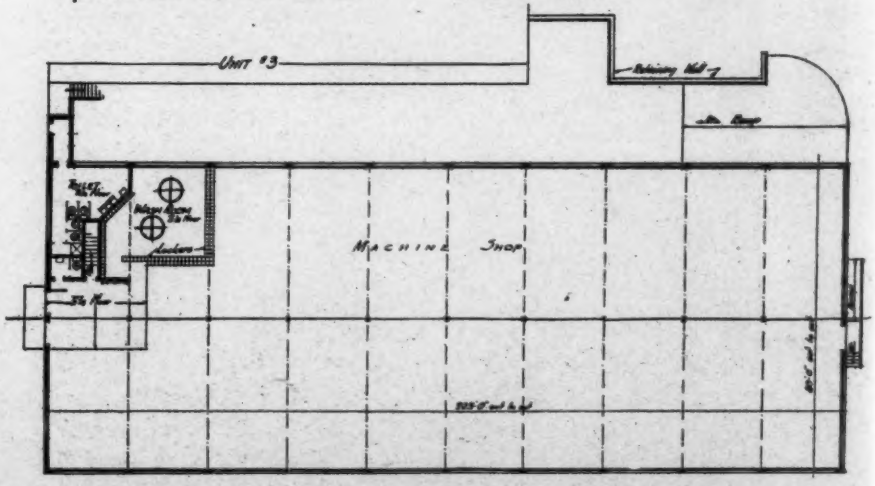
The building is heated by a temporary low pressure boiler plant located on the ground floor. When all units of the building program are completed, the heating load will be transferred to a permanent central boiler plant.

Equipment. The equipment cost is about $300,000, of which about $100,000 is new and modern. The new equipment is chiefly in the toolmaking section.

Financial Data. The building was constructed by the Works Project Administration. In spite of serious labor problems, this agency carried the building to completion with commendable efficiency and speed. The sponsor's contribution was higher than originally contemplated because a considerable percentage of skilled labor had to be employed by the school district.

DR. R. L. COOLEY'S CURRICULUM BUILDING TENETS

1. The need of the student determines the curriculum.
2. Education that is "inoculation" rather than a "packing it in."
3. The vital need for culture and cultural subjects.
4. A flexible course of study that will help the student take his place in a rapidly changing society.
5. A definite contribution to business.
6. The building of citizenship through good character traits.



Ground Floor Plan, Unit 4, Williamsport Technical Institute, Williamsport, Pennsylvania

The Owensboro Technical High School

E. C. LANDBERG[1]

The growth of modern education in American cities has embraced not only new subjects, new methods, and new objectives but also entirely new types of school organization. All of these developments have rendered the old classroom type of building less adapted to give efficient service and have necessitated more careful planning of functional instructional areas arranged for the special activities of the new types of classes, and of personal and group instruction, of study, work, play, and special forms of activity. These facts and the periodic study of local educational and social needs have led the Owensboro, Ky., board of education to study the building plant situation and to carry on a building program which will maintain the entire plant at a high point of service and efficiency. The new Owensboro Technical High School is an important unit in the program.[2]

In the erection of the new technical high school, the board of education has sought to serve the present educational program and to anticipate future needs and demands for industrial arts and vocational education through a flexible plant fully adapted to a constantly growing program in these fields.

Owensboro is primarily an industrial city—an important part of the Cincinnati region which extends along the north and south banks of the Ohio River. Analysis of the local situation has disclosed the fact that 79 per cent of the parents of high school pupils are employed in industrial occupations and that an equally high percentage of the present enrollment will find their way into mechanical or industrial jobs. The need of a technical high school which should be more than a source of the bare elements of mechanical skill and information was clearly indicated. Recent labor laws covering age employment, minimum wages, and other aspects of youth welfare put restrictions upon the apprentice method of learning the trades and make it necessary for the schools to retain students and to provide basic knowledge and skills which industry formerly provided. While the war effort has somewhat interfered with the program in force before Pearl Harbor, preinduction courses have been of equal importance. Both before the war and at present the school has the duty to provide courses which prepare directly for important occupations. The limited academic offerings of the older type of high school are not sufficient for large groups of children.

The automotive shop is equipped to undertake major repair jobs as well as routine service work

The auditorium-gymnasium has been found particularly flexible in use

The new Owensboro Technical High School offers work in the shop and related courses needed for technical, commercial, and industrial departments under a full four-year program. Academic subjects, supporting the industrial arts and vocational subjects, are emphasized. The school is essentially a finishing school for those who must enter work after graduation or even at the end of any earlier school year. Cooperative classes have been organized for students who must earn while they learn, and boys and girls in the upper classes spend alternate periods in school and in local workshops or stores. The special courses for girls include office work and stenography, homemaking, sewing, cooking, beauty culture; the vocational courses for boys are largely limited to auto mechanics, woodworking, machine-shop practice, electric wiring and motor repair, printing, aviation ground work, welding, drafting, and showcard writing.

The Owensboro Technical High School, considered one of the finest vocational schools

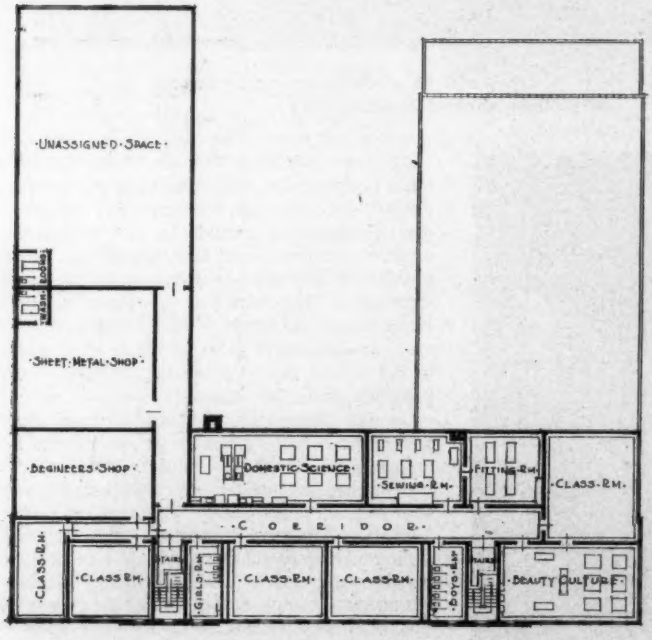
[1]Member of the Firm of E. C. and G. T. Landberg, Architects, Cincinnati, Ohio.

[2]The Robert E. Lee School, an elementary building, erected under the program, was reviewed in the SCHOOL BOARD JOURNAL, December, 1938, p. 35.

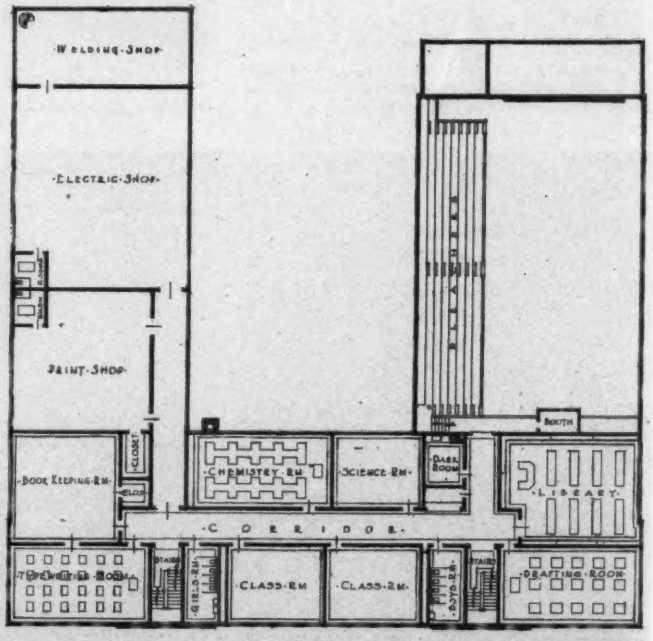
General Exterior, Owensboro Technical High School, Owensboro, Kentucky. — E. C. Landberg, Architect, Cincinnati, Ohio

in the state of Kentucky, was completed in 1941, at a cost of $199,751. This three-story, U-shaped structure, located at the corner of Frederica and Fifteenth Sts., in the city of Owensboro, Ky., is completely surrounded by many large and beautiful ancestral trees, which lend dignity and atmosphere to the colonial style of architecture employed for the exterior.

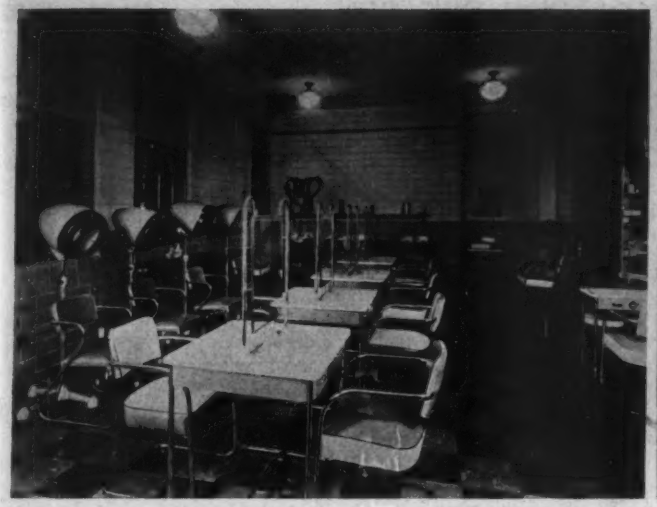
The arrangement of rooms has been made to provide for the greatest instructional and administrative efficiency. The cafeteria and kitchen are centrally located on the first floor; rest rooms on all floors are situated near the stairs; the shops are far enough away from



Third Floor Plan, Owensboro Technical High School, Owensboro, Kentucky

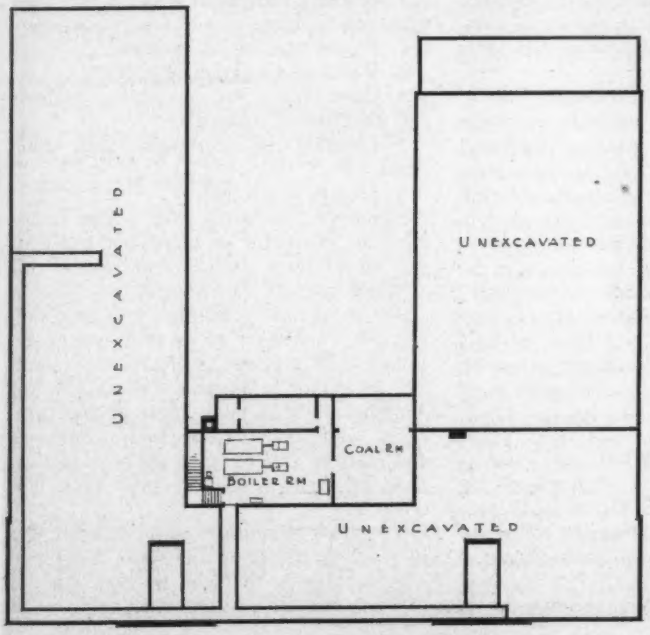


Second Floor Plan, Owensboro Technical High School, Owensboro, Kentucky

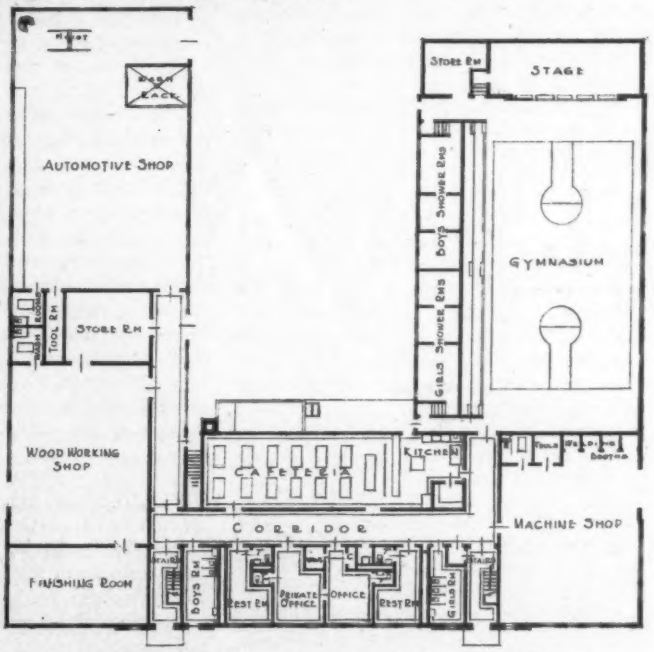


Left: the beauty culture laboratory. Right: the welding shop

Left: the main woodworking shop has a full complement of machines and hand tools. Right: the machine shop provides experience in every aspect of machine-tool operation



Basement Plan, Owensboro Technical High School, Owensboro,. Kentucky. — E. C. Landberg, Architect, Cincinnati, Ohio



First Floor Plan, Owensboro Technical High School, Owensboro, Kentucky. — E. C. Landberg, Architect, Cincinnati, Ohio

the academic classrooms so that noise and odors do not interfere with study. This last has been accomplished by placing the shops in the left arm of the "U." The automotive shop is located on the ground floor, making it possible to drive cars in from the street.

The right arm of the building contains a 97 by 65-ft. combination auditorium-gymnasium, complete with stage and bleachers. Adjoining are locker rooms, shower rooms, etc.

The bottom of the "U," or front section of the building, has been devoted to offices on the first floor and classrooms on the second floor, including a library and study hall. The third floor has been largely set apart for the girls, for here are located the domestic science rooms, beauty culture laboratory, etc., in addition to five classrooms.

Built with all concrete frame and floors and brick walls, the building is fireproof and will resist the usual wear and tear for many decades. It is planned so that, with very little expense, partitions can be moved and reset, thus providing the flexibility which modern planning for an expanding educational program dictates.

The exterior walls are red, sand finish, mingled-shade brick with Indiana limestone trim. The sloping roofs are of slate; flat roofs are of poured gypsum. All interior partitions are glazed tile of a light buff color with a wainscot of a darker shade. The ceilings in the classrooms, corridors, auditorium, and offices are finished with acoustical plaster. The floor of the gymnasium is maple, laid in blocks. The concrete floors of the classrooms, corridors, and offices are covered with alternate blocks of marbelized tan and brown asphalt tile. In all shop areas the concrete floors have been treated with a hardening material to make them dustproof. The lobbies, stair treads, landings, and rest rooms are terrazzo. Blackboards are of natural slate. All interior trim is painted a pleasing light "school brown" to harmonize with the walls and floors.

The building is complete in its mechanical and its electrical equipment so that the student body will have efficient conditions under which they will learn. The health of students and teaching staff is fully provided for by controlled ventilation of the most modern type and by properly designed lighting. The radio system is arranged so that the student body can hear any outside broadcast the teachers may wish them to hear. In addition, records can be used for musical and instructional programs, and announcements can be made directly from the main office. There is also a talk-back feature so that each teacher can speak from the room and be heard by the principal at the office. A telephone system for intercommunication between the office, the shops, and the classrooms is also provided.

The building is complete in every respect to provide adequate academic and technical training for both boys and girls.

The plans and specifications were prepared by E. C. and G. T. Landberg, registered architects, of Cincinnati, Ohio, and resident supervision was provided by the architects out of their own organization.

Layout and Equipment for a Vocational Radio Shop

JOSEPH MURRI*

A vocational radio shop in a unit trade school is a shop devoted entirely to the training of mechanics for the radio field. The shop must have facilities for training learners for positions of construction, maintenance and operation of radio receivers, transmitters, power amplifiers, television and electronic devices.

The field of radio, while being very great today, especially because of the war, will be far greater after the war because of the many developments now in progress. Some of the civil positions available to radio mechanics are: independent service of home and auto receiving sets; wholesale and retail service departments; factory assembly, inspection, trouble shooting and final testers; maintenance of police radios; maintenance and operation of land station transmitters; maintenance and operation of Maritime radio apparatus. During the present emergency, a vast number of radiomen are greatly needed in all departments of our armed service, especially in the signal corps.

Therefore, the radio shop should contain the most modern type of equipment.

The training should be realistic, and only up-to-date types of radio apparatus should be used.

Since the locality will greatly influence the training to be given in the radio shop, a study of the community requirements should be made.

The Philadelphia area contains two of the largest radio manufacturing plants in the eastern part of the country; therefore, the training to be given in the radio shop in this section, should emphasize fabrication, repairing, testing and inspection of radio apparatus and equipment. Since in many cases radio shops are also used by the radio repairmen trainees of the signal corps, the instruction should also include radio maintenance and operation of military equipment. Radio-telegraph code operating should be given in a separate room outside of the radio shop.

Shop Layout

The proposed layout shown and described in this article is a planned layout, embodying some improvements to be desired on present vocational radio shops.

Recommended Space

Leading school architects recommend the following:[1]

1. Radio mechanics shop — 40 square feet floor area space per student;
2. Electrical wiring shop — 70 square feet floor area space per student;
3. Ceiling height — 12 to 16 feet,[2] with a minimum of 11 feet.[3]
4. Ratio of width of shops to length — 1:1 to 1:2.[3] The size of the shop will greatly depend upon the number of students occupying it at one time, the type of instruction to be given and in the case of established schools, the room available.

Laboratory work is included in the shop described in this study. The size of the shop is based on approximately 25 students occupying it at one time. This is about the maximum number that an instructor can handle efficiently at one time.

The floor plan shows a proposed shop and theory room. The shop space is approximately 25 ft. wide and 50 ft. long. For future expansion, a duplicate extension may be made using the same storeroom to serve both shops.

Shop Arrangement

In arranging the shop several factors must be considered which experience has shown cannot be disregarded. These have to do with:

1. Proper arranging of workbenches with reference to light;
2. Proper spacing of benches;
3. Width and location of aisles;
4. Open spaces for assembling projects and handling of materials;
5. Location of storeroom and wash stands;
6. Storage of projects.

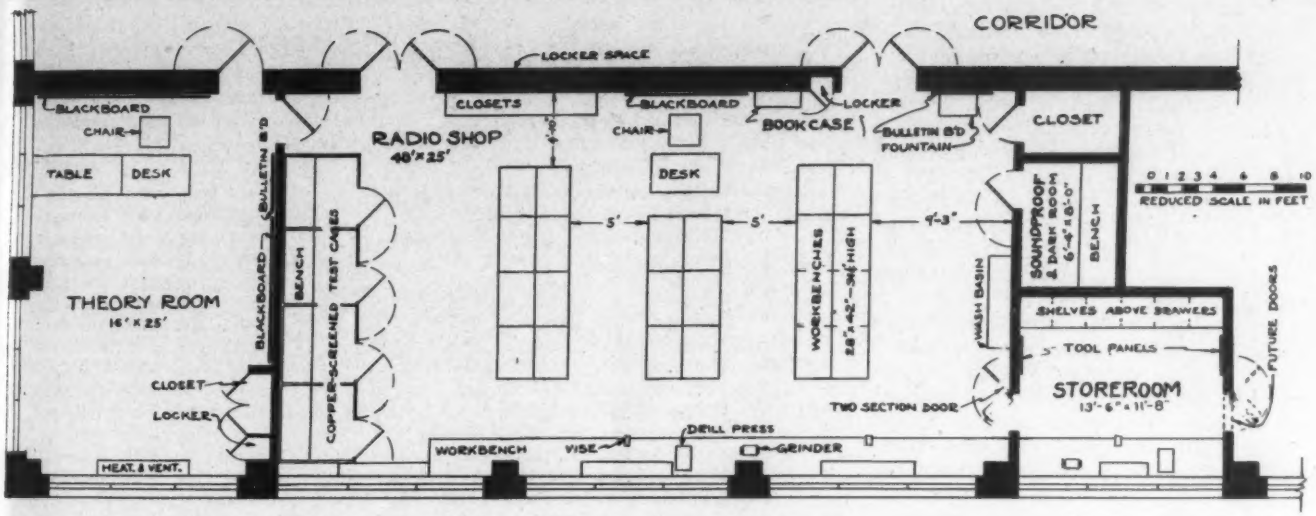
Sometimes, as in the case of new buildings, the instructor or supervisor can control all of these factors, but usually his problem consists in carefully studying a given set of fixed conditions and adjusting movable equipment so as to approximate, as nearly as possible, an ideal arrangement. The instructor or supervisor responsible for planning the shop must know general principles which have come from experience and must be able to make the best applications of these principles under particular conditions.

There are advantages and disadvantages in teaching theory in the shop. The main disadvantage is that the learners are not in a comfortable position when using stools

*Edward Bok Vocational School, Philadelphia, Pa., and High School, Chester, Pa.

[1] *Architectural Record Magazine*, April, 1940.

[2] *The School Plant* — Bulletin No. 86, Pennsylvania Dept. of Public Instruction.



Floor plan of vocational radio shop

and writing on workbenches. Another disadvantage is that books and papers are very easily soiled and torn. The chief advantage is that the atmosphere is that of a shop. Opinion is divided on having a separate theory room. The advantages of an adjacent theory room are several; a better control and organization of the class may be had especially at the beginning and at the end of the trade periods. The comfort and ease of the learners in armchairs, the cleanliness of the room, the placing of the learners' belongings when going into the shop and the ease of blackboard use.

The author has decided to use an adjacent theory room with a large table for demonstrations, as is shown in the floor plan.

Illumination

The desirable condition for the shop and theory room is natural illumination, with an abundance of evenly diffused light with a minimum of shadows.

The light source area of natural illumination must equal at least 16 per cent of the floor space. The most desirable condition, is to have windows on the long side of the room (unilateral lighting), so that the light comes from the left side of the learners. When windows are placed on the long side and rear of the room (bilateral lighting), the total light source area should be increased to 20 per cent, or one fifth of the floor space. Cross lighting (opposite sides) and light from the front of seated learners should not be used.[8]

Where the light comes from three sides of the room, the amount of light from each side should be regulated by shades or Venetian blinds so that the strongest light comes from the left and the weakest light from the right and front.

Blackboards and bulletin boards should not be placed on a wall in which there are windows. They should be so placed as to have the light fall on them.

Provisions should be made for adequate artificial as well as natural lighting.

Standards of artificial illumination for classrooms and shops are: 8 foot-candles minimum, 12 foot-candles are recommended.[8]

Indirect or semi-indirect lighting with their proper luminaries and lamp sizes are satisfactory systems for school installations. The lighting source should be enclosed or covered from view, glare from unit avoided, shadows soft or graded. The luminaries or fixtures should be simple in design, well proportioned, and in a harmonious relation with the decorative or architectural fixtures of the surroundings.[8]

Type of Workbenches

Flat 2 by 28 by 42-in. wood top benches should be used. The top is to be supported by two strong metal supports 32 in. high, making the total height of the bench 34 in. A cross wood foot rest should be placed 13 in. above the floor.

A strong wire basket for holding the soldering irons should be placed on the inside of the metal support which may be fastened about 8 in. below the wood top, on the right side of the bench. About a square foot of asbestos sheet should be placed beneath the top, directly above the wire basket just mentioned. Placing the soldering iron in the wire basket will prevent burns and accidental damage to equipment.

A twin duplex receptacle for 110 volts — 60 cycles, should be placed on the right underside of the wood top part of the bench, and antenna and ground connections on the left front bench support.

Stools 22 in. high should be provided for the learners.

[8] *The School Plant* — Bulletin No. 86, Pennsylvania Dept. of Public Instruction.

Type of Test Cages

Test cages are small rooms having a copper screen on all sides. All delicate measurements of radio receivers, such as sensitivity, selectivity, fidelity hum, etc., are made inside these closed cages so as to prevent external radio-frequency disturbances. A screened door making contact with the metal edges is used as the entrance and exit. A lock should be provided on the outside of the door, so as to leave the test equipment and sets connected, thereby representing a saving of time on the part of the learner.

The frame work of the 5 by 5-ft. cages may be made of 2 by 4 in. by 8-ft. wood studs. A 16-mesh copper screen should be placed all around, including under the floor of the cage. All joints should be thoroughly soldered and the screen grounded.

A wooden table 34 in. high, 2 ft. wide, and the entire width of the inside of the cage should be installed opposite the door. Outlets similar to the workbenches should also be installed. A lighting fixture with a 200-watt bulb should be placed on the outside top of each cage.

Storeroom

The storeroom should be situated in the shop; the entrance door should consist of a top and lower half.

The most common tools, such as screw drivers, pliers, hammers, and knives, should be arranged on a flat board with suitable holders, so that a check up at the end of the period can be made at a glance. For tools that cannot easily be mounted, shelves should be used with properly constructed compartments; each compartment should be clearly labeled.

Equipment such as ohmmeters, voltmeters, signal generators, oscilloscopes, etc., should also be placed on shelves and in compartments, each compartment being properly labeled. This is of great help to a storeroom keeper in locating and replacing equipment. Damaged equipment should have a tag on it describing the defect.

Hardware such as nuts, screws, washers, nails, rivets, eyelets, etc., may be placed in labeled glass jars on shelves or in small metal drawers with a label and sample on each drawer.

Supplies such as carbon resistors, tubular condensers, mica condensers, tube bases, etc., may also be placed in glass jars or metal drawers, with the proper information on the label. Wire wound resistors, transformers, filter capacitors, iron core choke coils, and radio-frequency coils should be placed in metal drawers and labeled. Spools of wire and wire solder should be arranged on a vertical spindle rack, so that the proper amount can easily be drawn and cut.

The storeroom should contain a properly lighted workbench, so that the storeroom attendant may do repairing, or work on his projects. It is very convenient to have a perpetual inventory card file which should be kept up to date by the storeroom attendant and supervised by the instructor. Where a paid storeroom attendant is held, a greater responsibility may be given to him; otherwise, the instructor will have to keep a closer supervision, as learners are likely to be careless in the replacing of materials.

Storage of Projects

Learner's project should be stored in metal cabinets or closets in the shop. Solid metal doors or glass paneled doors may be used. While some instructors prefer the glass type door, metal doors are more durable and have a better appearance as glass is subject to breakage by the learners.

Placement of Books

A book cabinet or closet with glass doors should also be kept in the shop. Circuit diagram manuals, trade catalogs, and reference books may be stored in it and locked when not in use. The instructor or a reliable learner only should have access to the book cabinet, so that the responsibilty for the care of the books may be definitely determined when necessary.

Radio Receivers

The shop should contain some of the latest radio receivers; and several used and defective receivers, that can be bought cheaply from dealers or distributors who ordinarily would destroy them.

Where the shop also is used for war-production classes, it is advisable to obtain, if possible, representative types of army and navy receivers.

Test Item No.	Equipment Quantity	Name of Apparatus	Remarks
		Equipment	
1	4	Milliammeter, d.c., 0–1 M. A. scale	3-in. type with mounts
2	4	Milliammeter, d.c., 0–10 M. A. scale	3-in. type with mounts
3	4	Milliammeter, d.c., 0–100 M. A. scale	3-in. type with mounts
4	2	Ammeter, d.c., 0–5 A. scale	3-in. type with mounts
5	2	Ammeter, a.c., 0–5 A. scale	3-in. type with mounts
6	2	Ammeter, a.c., 0–10 A. scale	3-in. type with mounts
7	2	Ammeter, High frequency, 0–1.5 A.	3-in. type with mounts
8	2	Ammeter, High frequency, 0–5 A.	3-in. type with mounts
9	10	Voltmeter, d.c., 0–2.5–25–250–750 V.	Lab. type, 1000 ohms/volt
10	2	Voltmeter, a.c., 0–5 V.	3-in. type with mounts
11	2	Voltmeter, a.c., 0–150 V.	3-in. type with mounts
12	2	Galvanometer, d.c., 30–0–30 scale	3-in. type with mounts
13	2	Galvanometer, r.f., thermocouple type	3-in. type with mounts
14	2	Microammeter, d.c., 0–100 UA	3-in. type with mounts
15	1	Wattmeter, a.c., 0–500W (110V–5A)	Laboratory type
16	1	Power level indicator	For output measurements
17	2	Multirange test meter	20,000 ohms per volt
18	1	Vacuum tube voltmeter	Multirange type
19	10	Volt–ohm–milliammeter (d.c. & a.c.)	Small type, multirange
20	6	Experimental cell	With various elements
21	25	No. 6 dry cell	
22	2	Storage batteries — 6 volts	
23	10	Small knife switches — D.P.D.T.	
24	10	Small knife switches — S.P.D.T.	
25	2	Line voltage control — a.c.	"Variac" type
26	10	Magnetic compass	Approximately 1-in. dia.
27	1	Magnetic compass needle large	For demonstrations
28	1	Magnetic inclination needle large	For demonstrations
29	10	Permanent bar magnet	
30	10	Permanent *U* magnet	
31	20	Telephone head set	
32	2	Thermometers	0–225 deg. F.
33	2	Battery hydrometer	
34	2	R.f. signal generator	Portable service type
35	2	Tube tester	
36	1	*Q* meter	For measurements at r.f.
37	1	Signal generator	Laboratory type
38	2	Cathode-ray oscilloscope	3-in. laboratory type
39	1	Beat frequency audio generator	
40	2	Crystal calibrator	
41	1	Regulated power unit — d.c. (6V–20A)	For auto sets
42	1	Set analyzer	
43	1	Capacity meter	For paper and electrolytic capacitors
44	10	B — batteries — 45V, with 22½V. tap	
45	1	Calibrated (precision) air condenser	500 m.m.f. scale
46	1	Carbon microphone	
47	1	Velocity microphone	
48	1	Crystal microphone	
49	3	Telephone hand set	Microphone and receiver
50	2	Decade resistance box	1–10–100–1000 ohms
51	2	Decade resistance box	0.1M–1.M–10.M–100.M ohms
52	10	Key and buzzer set	For code practice
53	4	High frequency buzzer	For wave meters
54	1	Frequency modulator	For wobbler circuits
55	2	D.c. power supply (regulated output)	500 V — 100 M.A.
56	1	Automatic code sending machine	
57	1	16mm. movie projector with sound track	
58	1	Photoelectric cell unit	
59	1	Power amplifier (30W)	
60	1	Automobile antenna	Vertical type
61	1	Dipole antenna	5 meter type
62	1	Broadcast and short-wave antenna	With transmission line
63	1	Direction-finder antenna	With transmission line
		Note: The antennas may be constructed by the radio shop.	

The bringing in of radio receivers by the more advanced learners for repairs is advisable, but all parts needed should be purchased by the learners outside of the school. This will prevent unnecessary responsibilities on the part of the instructor.

A television receiver should also be included.

Radio Transmitters

A few small transmitters of the amateur type should be included: a 5-meter transmitter, a transmitter with plug-in type coils ranging from 20 to 500 meter wave of the amplitude-modulation type, and an ultra-shortwave transmitter of the frequency modulation type.

Unless the learners are being prepared especially for commercial radio communications, greater emphasis of instruction should be given to home receivers.

Conclusion

The planning of a vocational radio shop as with most other shops should be based on the objectives of the course and the activities of the learners, the selection of subject matter and methods that will attain the objectives.

An ideal situation in a building to be constructed is for the instructor to design his own shop. As this is not always possible, the instructor should carefully study the space already available in the school building for the best shop arrangement.

A very helpful method in planning a shop is to make a scale drawing of the plan of the room or rooms to be equipped. Cut small pieces of cardboard representing the plan to scale of each piece of stationary equipment; the best arrangement may then be secured by trial.

The selection of equipment will also depend entirely on the objectives to be achieved in the course. An important point to consider is that the equipment should be the latest and best which is representative of that used in industry. Antiquated equipment or toys should always be avoided, as instructional information of obsolete radio apparatus is of no value today and miniature equipment is not representative of true conditions that the learner will later face.

Community Repair Shop

LOUIS M. ROEHL*

An urgent need in many rural communities is a general repair shop in which may be done any one of the many repair jobs that arise daily on the farms and in the homes. There is bound to be an increasing demand for the service of men who can fix things. Little new equipment used on farms and in the homes is being made, due to the fact that our materials are going into the production of war goods. And when hostilities cease it will still be some time before industry can have ready for the general public new equipment to replace the old. At present there are farm machines to repair, necessitating the service of one who can operate a forge and do arc and acetylene welding. Household equipment needs one who is familiar with electricity and general mechanics. One operating a community repair shop will find calls for his plumbing tools to service pumps, water supply, and sewage disposal systems. He will find his time in demand to grind all manner of tools; gum, file and set crosscut, circular and hand saws. Motors are used extensively and a metal lathe needs an operator to turn down the commutators when they refuse to deliver full-load service. Furniture in many homes is in need of repair and refinishing. Horses still need to be shod and many communities are in dire need of a craftsman who can shoe them. Many construction jobs in carpentry can be done so much more economically by one who is equipped for and has the training to do them than farmers. So the shop operator will find call for the construction of ensilage feed carts, "hay riggings," poultry appliances, and similar items of farm equipment. The chances are that one who sets himself up in a community repair shop and delivers a good quality of work will soon find himself so swamped with work that he will need help. In that event his move might well be the selection of men whose mechanical ability and interests vary, one who likes to weld and do metalworking, another who enjoys doing things electric, and as need arises still another whose ability lies in the carpentry trade.

In presenting this idea to a group of young men from the rural areas a pleasant surprise came to us in having two state that need for such a shop exists in their home town, and both of them were encouraged to think they might set themselves up in such a business. Both had in mind a building in which to start. Their ideas and plans were similar. Each could do some of the work just outlined and knew where and how he could get training in more. One could do good work in metalworking, and claimed he had done some machinery repairing. He knew a welder who would teach him the welder's art and he stated with a sparkle of light in his eye that he could see himself operating a community shop where he lives and get all the work he can take care of. That he will do good work is attested to by the fact that his work with us was of a high order.

It is not likely that anyone will start from scratch and draw up the plans for a new building and seek capital for its construction and equipment. He is more likely to look around for some building that can be had at a nominal rent or purchase price, and with his own labor do what needs to be done to get going. He will start in a small way if he is wise and gradually add as call arises, always with earnings of his own hands.

In submitting a suggestive plan of a community repair shop herewith it is done with the idea that any one contemplating setting up in business might pick up some ideas that will be helpful in his planning.

The building is 30 by 44 ft. with two supporting posts for a second floor. Windows are placed at sides and ends so that there is ample light for work at any place on the floor. A 10-ft. overhead door is better than a swinging door because it interferes less with floor space if the doors swing in and does not require attention for wind and snow as do doors that swing out.

A common outside door is also placed at the front. Another outside door may be placed elsewhere if need for it exists.

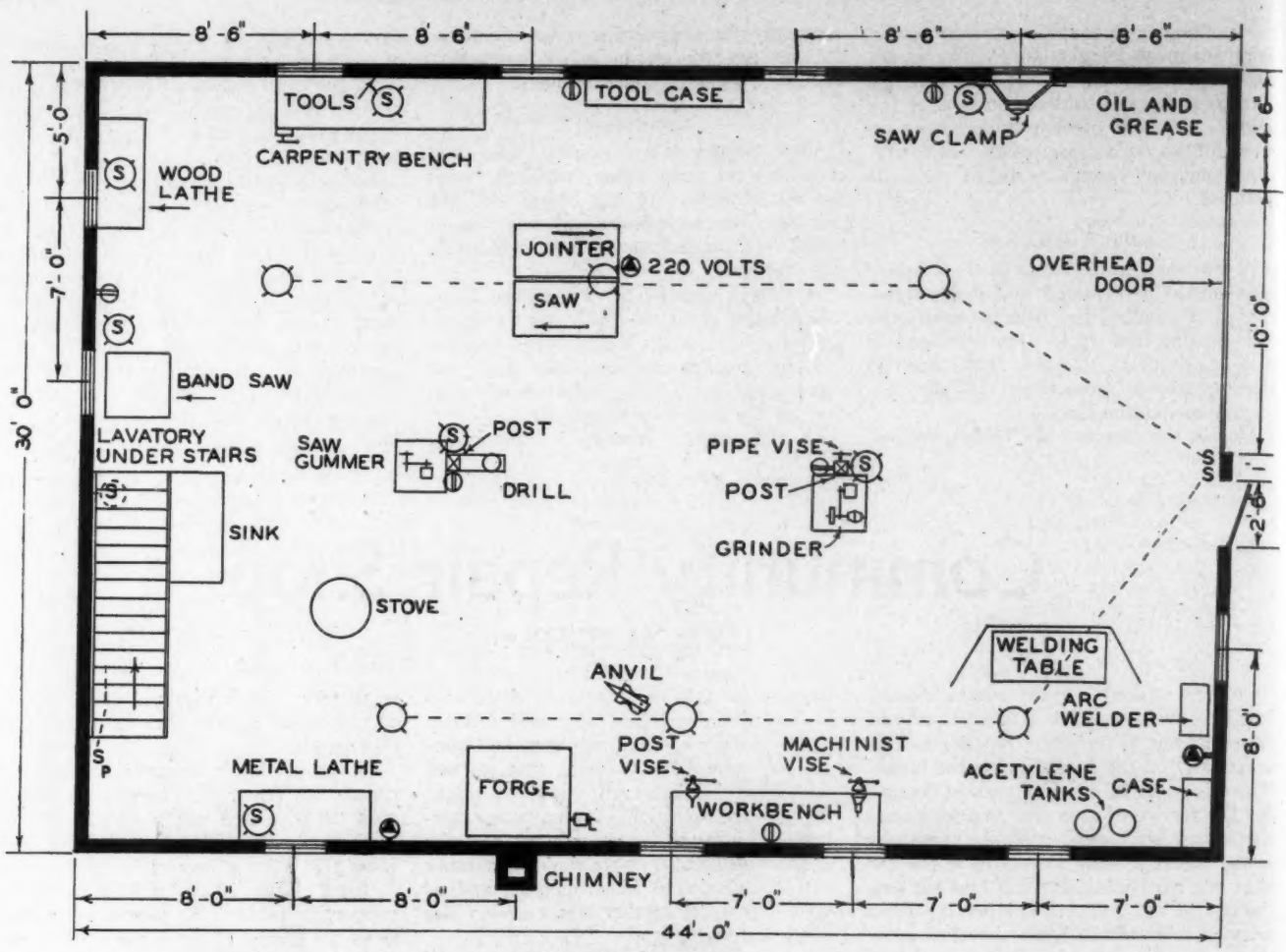
A shop of this kind requires artificial light, ample and well distributed, and thus six ceiling lights are suggested, with extra lights over the workbenches at machines and grinders. Service outlets are placed at side and end walls and on the two supporting posts for motors on machines and for extension cords.

Even though there are several machines in the shop, they are all placed so as to keep a clear floor space in front of the big door to allow a truck, tractor, mowing machine, corn harvester, or other machines to be run in, or when a construction job of "hay riggin" dimensions is considered.

One reason why the old-time smith faded from the rural setup is that he did too few kinds of work. He did horseshoeing, tire setting, and some work on machinery.

With the advent of trucks, tractors, and

*Cornell University, Ithaca, N. Y.



Community repair shop

cars, horses were used in smaller numbers. Machinery repair work was not in such great demand due to the fact that new machinery was plentiful and nimble-tongued salesmen were active. The picture has changed and farmers wish the old smith was back. His passing is a distinct national loss. Those who are to take his place will find demand for the work he did, plus more that is now urgent.

In some communities the traveling smith has and is giving good service by going from farm to farm with his rig, shoeing horses. Lack of gas and rubber puts a crimp in his program so the signs point to a community repair shop, where the smith's work of a bygone day may be done, and where the farmers may take work which they are not equipped to do themselves. For this reason, the shop plan shown herewith includes a forge with its chimney to draw smoke from the forge and stove.

Much of the work formerly done at the forge is now done by arc and acetylene welding. As a matter of fact a welding outfit is as necessary to do farm repair work as is the sewing machine to the women folks. Few farmers have enough use for a welder to warrant its ownership. That would be far from good farm management. On the other hand each community has enough use for a welding outfit to furnish full employment for one man. By having one in the community, both shop operator and farmer win.

As a general thing farmers have enough tools to make general repairs, but in many instances they are not in good working condition. Drills exist in ample number but equipment and ability to fit them are lacking. Did you ever see a sharp saw on a farm? Perhaps so but in more instances the saws are left as the nail shaped it. The farmer is in too big a hurry to fit it or he tries to file it and it gets worse as he proceeds. This also holds for crosscut and circular saws. Our suggestion to the operator of the community repair shop is to equip with a grinder that has two wheels, one fine grit to grind drills, knives, plane irons, wood chisels, etc., and one medium or coarse wheel for taking down ensilage cutter blades, thick axes, and other heavy work. A motor-driven grinding head is needed for a saw gummer with two sizes of wheels, ¼ and ⅜ in., for the crosscut and buzz saw work. It is good practice to have one machine for general grinding work and another grinder head fitted with saw gummers. To interchange them is not good shop practice.

One who can file saws will have call for his services in that work. The first frost will find an influx of farmers headed for the community shop with an assortment of crosscut and hand saws under their arms and a rusty buzz saw badly in need of fittting.

In most farm communities there are hundreds of small motors in use on farms and in the homes and many of them do not deliver the full load of service for which they were made. This may be due to need of cleaning or the commutators may need turning down. For this work alone the metal lathe will find enough use to warrant its place in the community shop. Often, too, work arises in connection with machinery repairing that needs a lathe.

A shop of this kind might well be two story and the second floor used for storage and for such work as the operator may choose to do in repairing and refinishing

furniture. It will be noted in the plan that a stair is placed at the rear of the shop where it is least in the way.

As one thinks of a shop of this kind in operation, he is not likely to see the need for woodworking machinery. Shop experience reveals that work of some kind seems to show up daily that calls for a table saw, jointer, wood lathe, or band saw. If one is to build ensilage carts, potato crates, or poultry equipment and do similar work he will find the machines necessary to make a go of it. Saw and jointer in any shop must be placed so that a 16-ft. board can be run through and have 16 ft. of space fore and aft. It will be noted in the plan that they are placed side by side and in operation the wood runs in opposite directions.

What every community wants and needs is a place where anybody can take any item of equipment he may possess that is in need of repair and have it done by someone who knows how at a reasonable cost.

Storing Woodworking Project Material

G. LESTER STEINHOFF*

The storage of woodworking project materials before assembling begins is a problem that confronts many instructors in the industrial-arts laboratory. This problem involves (1) sufficient space to care for the maximum size of woodworking pieces which will need to be stored; (2) safety both for materials stored and for the persons storing them; (3) storage compartments which will be sufficiently accessible so as to require the minimum time of the pupil to get his materials from the compartments and to store them again at the end of class; (4) an arrangement that will permit materials to be placed in the compartment and removed from it with a minimum of difficulty.

Too often only makeshift arrangements are provided which cause much waste of time, misplaced pieces, and damaged materials. The problem appears to be growing, apparently because of the increase in size of classes, and also because of the change in size and type of projects. According to Siepert:[1]

"History does not record how the first teacher of shop work cared for unfinished work of his pupils during the period of time between meeting of class. Possibly that difficulty did not arise until more recent times, but the followers have advised many schemes ranging from the makeshift open shelf to something more practical and convenient; the attempt in every instance has been to provide adequate storing space."

In recent years, Engelhardt, of Teachers College, Columbia University, has compiled

Fig. 3. Storage arrangement at Tulsa, Okla.

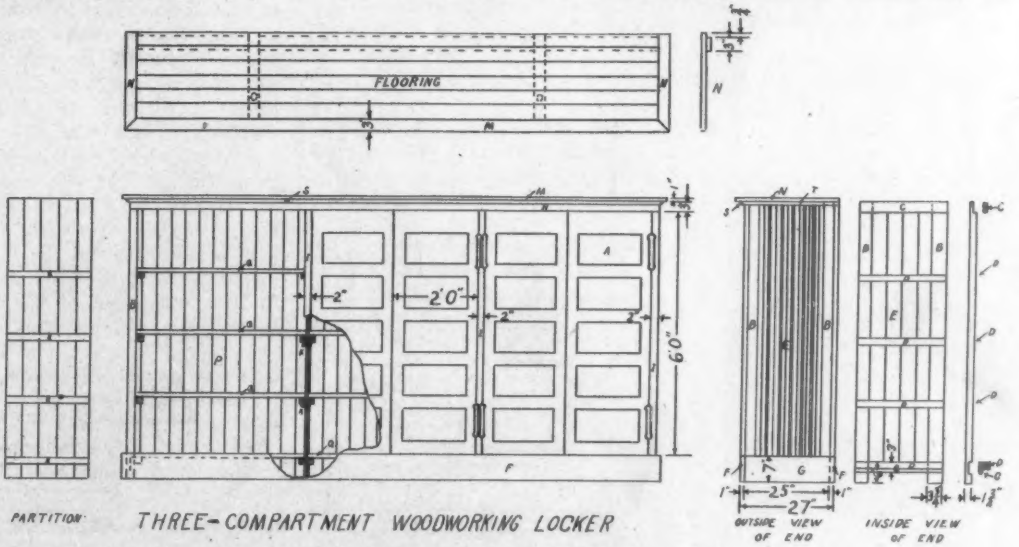


Fig. 1. Three-compartment woodworking locker

*Formerly at High School, Beaver Dam, Wis. Now with U. S. Navy.

[1]Siepert, Albert F., "Lockers for Unfinished Work," *Manual Training Magazine*, 16:498–499, 1915.

timesaving standard data for school building. Engelhardt, in the industrial-arts section of the paper, reveals:[2]

"Project storage may be in large lockers, shelves, etc., perhaps on a mezzanine over part of the shop space."

The acceptable minimum for project storage is 60 sq. ft., and 140 sq. ft. the usual maximum.

In a study of this storage problem, 119 teachers in the industrial-arts field contributed to the development of criteria for judging storage arrangements. This criteria should be of great value to anyone planning industrial-arts shops or laboratories.

Location of compartments: There seems to be a feeling that compartments under the bench are convenient and satisfactory, especially in the lower grades, but that they alone are not enough and some other provi-

[2]Engelhardt, U. L., Jr., "Modern High School Plant Design," *Architectural Record*, 89:96, 1939.

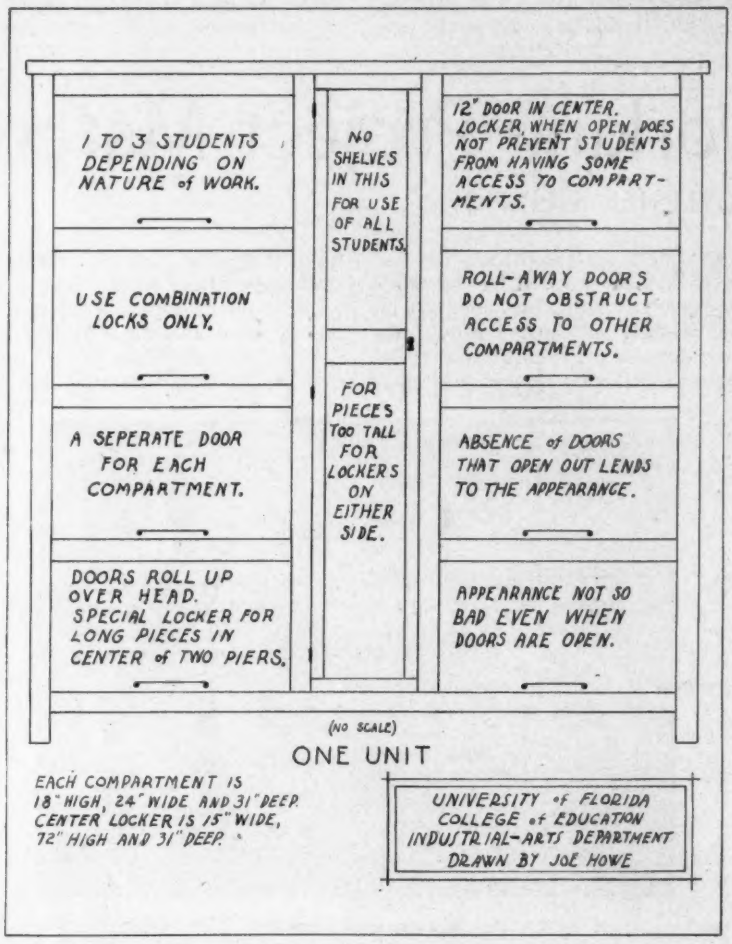

1 TO 3 STUDENTS DEPENDING ON NATURE of WORK.
USE COMBINATION LOCKS ONLY.
A SEPERATE DOOR FOR EACH COMPARTMENT.
DOORS ROLL UP OVER HEAD. SPECIAL LOCKER FOR LONG PIECES IN CENTER of TWO PIERS.
NO SHELVES IN THIS FOR USE OF ALL STUDENTS.
FOR PIECES TOO TALL FOR LOCKERS ON EITHER SIDE.
12" DOOR IN CENTER. LOCKER, WHEN OPEN, DOES NOT PREVENT STUDENTS FROM HAVING SOME ACCESS TO COMPARTMENTS.
ROLL-AWAY DOORS DO NOT OBSTRUCT ACCESS TO OTHER COMPARTMENTS.
ABSENCE of DOORS THAT OPEN OUT LENDS TO THE APPEARANCE.
APPEARANCE NOT SO BAD EVEN WHEN DOORS ARE OPEN.
(NO SCALE)
ONE UNIT
EACH COMPARTMENT IS 18" HIGH, 24" WIDE AND 31" DEEP. CENTER LOCKER IS 15" WIDE, 72" HIGH AND 31" DEEP.
UNIVERSITY of FLORIDA COLLEGE of EDUCATION INDUSTRIAL-ARTS DEPARTMENT DRAWN BY JOE HOWE

Fig. 2. Slide-away door storage case

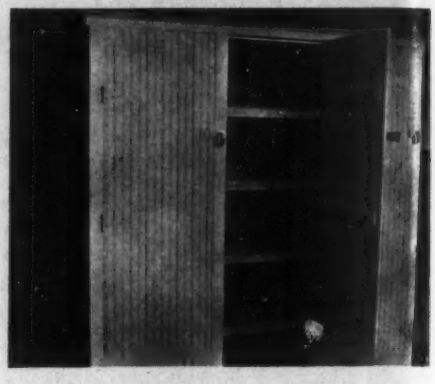


Fig. 4. Storage arrangement for many students

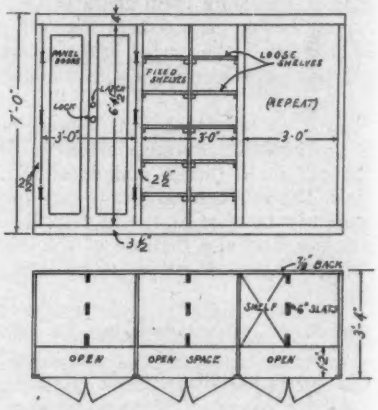


Fig. 6. Wall storage cases

Fig. 5. Storage cases with wire mesh doors

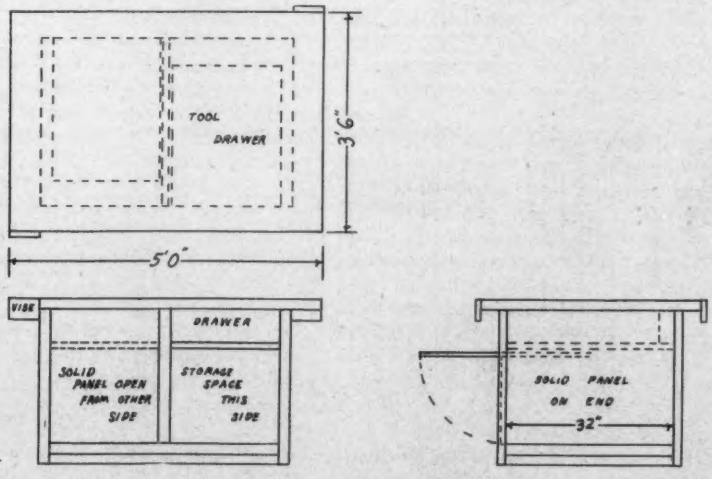


Fig. 7. Wooden bench storage case

sion for storage should be made. The space under the bench is waste space and can well be utilized for storage of small pieces.

A special room is not advisable unless it has a partial glass partition as discipline becomes more of a problem when students have access to more than one room.

A blank wall furnishes a satisfactory location for the compartment. Frequently a space in the center of the room may be utilized. Lockers built into the wall are most advisable. This can only be done during the construction of a new building, or when wall recesses are at hand.

Movable compartments and balconies or shelves seem to be unpopular types of storage.

The compartment should be built down to the floor, with the bottom shelf raised approximately 3 in. The case may extend up to 10 ft. in height. The average is about 6 ft. This height depends on the grade level, number of compartments needed to accommodate students and the arrangement for gaining access to the higher lockers.

Bibliography

Engelhardt, U. L., Jr., "Modern High School Plant Design," *Architectural Record*, 89:96, 1939.

Siepert, Albert F., "Lockers for Unfinished Work," *Manual Training Magazine*, 16:498–499, 1915.

Steinhoff, G. Lester, "Methods of Storing Woodworking Project Materials in the Industrial-Arts Laboratory," *Unpublished Master's Thesis*, Iowa State College, 1940.

Air Navigation Course

HUGH J. BETTS* and CHARLES A. BROWNING**

Early in the spring of 1942 a regional conference on air education was called in Nashville, Tenn. This meeting was sponsored jointly by the State Department of Education and the Civil Aeronautics Administration. The effects of this regional conference are now being felt throughout the entire area. Many high schools have introduced specific air education programs. Elementary and junior high school curriculum are being adjusted with surprising rapidity.

Throughout the entire system of the Knoxville City Schools, changes are taking place. All of the traditional courses in industrial arts have been discontinued for the duration. Replacing them are courses in blueprint reading, shop mathematics, model aircraft construction, and preinduction courses in electricity, radio, machine-shop work, and preflight aeronautics.

Only those courses which may be classified strictly as (1) preinduction, (2) preemployment, and (3) war service, will be taught for the duration.

The many changes already brought about in both the adult evening and day secondary schools are the direct results of the excellent leadership of Superintendent T. C. Prince; Director of Secondary Education Curtis Gentry; the principals of junior and senior high schools; and the industrial-arts teachers.

The course in air navigation as offered by the Knoxville High Adult Night School has been designed to meet the needs of men who are to become pilots in our armed forces.

The outline of the course was prepared from such government publications as:

1. *Practical Air Navigation*, Civil Aeronautics Administration, Bulletin No. 24.
2. *Pre-Flight Aeronautics in Secondary Schools*, U. S. Office of Education, Leaflet No. 63.
3. *Pre-Aviation Cadet Training in High School*, U. S. Office of Education, Leaflet No. 63.
4. *Instrument Flying Training*, War Department, Technical Manual.

Personnel of Class

The unit on air navigation is an integral part of a course in preflight aeronautics which began in September, 1942. Since the inception of the course, some fifty students, mostly men, have been enrolled. More than half of the students were members of the Air Corps Enlisted Reserve, awaiting call to begin training as flying cadets with the U. S. Army or Naval Air Forces. From week to week the men have received their orders to report for duty. Others, hearing of the value of the course, have come into the class to take the places of those who have been called to duty.

The units taught so far embrace aerodynamics (theory of flight), meteorology, and navigation. It is contemplated that these units will consume 108 instructional hours.

These units have been taught by the head of the science department of the Knoxville High School, who is a physics teacher in the day schools as well.

Outline of the Course

I. *Problems of Air Navigation*

II. *The Earth:* Its Form, Co-ordinates, and Representation
- *a*) Navigation on a spherical earth
- *b*) Co-ordinates of the earth
- *c*) Distance on a sphere
- *d*) Time
- *e*) Representation of a sphere
- *f*) Gnomonic, Mercator, and Lambert projections

III. *Chart Reading*
- *a*) Importance
- *b*) Properties of a chart
- *c*) Topographical information
- *d*) Cultural, physical, and aeronautical features
- *e*) Relief
- *f*) Symbols
- *g*) Scales

IV. *Cross Country Flying*
- *a*) Procedure
- *b*) Landmarks
- *c*) Flying a range
- *d*) Marking distance along a plotted route
- *e*) Marking time intervals
- *f*) Folding charts
- *g*) Safety regulations
- *h*) Wind and effect on full

V. *Instruments*
- *a*) Clock
- *b*) Compass
- *c*) Altimeter
- *d*) Air speed indicator
- *e*) Drift sight
- *f*) Artificial horizon
- *g*) Bank and turn indicator
- *h*) Rate of climb meter
- *i*) Directional gyro
- *j*) Radio navigation instruments

VI. *Air Navigation by Dead Reckoning*
- A. Basic problems in dead reckoning
  - 1) To measure the true course
  - 2) To find the magnetic course
  - 3) To find the compass course
  - 4) To find the compass heading
- B. 1) To find the magnetic heading
  - 2) To find the true heading
  - 3) To find the true course made good
  - 4) To plot the true course on the chart

VII. *Air Navigation Computer, Graphs, and Tables*
- *a*) The air navigation computer
- *b*) Conversion of percentage, velocities, and miles per hour velocities
- *c*) Finding the true air speed
- *d*) Time, speed, distance problems
- *e*) Correction for wind and determination of ground speed
- *f*) Correction to course and determina-

*Supervisor, Adult and Industrial-Arts Education, Knoxville, Tenn.
**Head of the Science Department, High School, Knoxville, Tenn.

tion of compass heading and ground speed by a double drift method
g) Finding wind correction and ground speed in flight from one observation with a drift indicator
h) Rectifying the heading and ground speed for the effect of wind
i) Radius of action

VIII. *The Practice of Navigation*
a) Contact flying
b) Instrument flying

IX. *An Elementary Consideration of Radio Navigation*

Recommended texts:

Science of Pre-Flight Aeronautics For High Schools by Aviation Education Research Group, Teachers College, Columbia University (N. Y.: Macmillan), 99 cents.

Practical Air Navigation, Civil Aeronautics Bulletin 24, U. S. Government Printing Office, Superintendent of Documents, $1.

Course of Study for Farm Shop

ELVIN J. BOMASTER*

Objectives for Farm-Shop Instruction

1. To develop proficiency in the tool processes and skills necessary to do farm jobs either through school or home experiences.
2. Give training in general farm construction work and repair jobs.
3. Encourage the student to set up a home farm workshop. Stress uniformity of equipment.
4. Develop the ability to select and purchase tools, materials, farm machinery, and other farm equipment, intelligently and also economically.
5. Create a desire in the boy to do good work.
6. Create a desire for workshop cleanliness, proper tool arrangement, proper equipment placing, care and upkeep of tools.
7. Co-ordinate school-shop work with work on farm, so farm work will be continued even after school is out.
8. Give the boy confidence to do the tasks he may meet on the farm.
9. To develop the ability to think and plan carefully and then carry through a worth-while project, related to the work on the farm.
10. To develop a greater interest in vocational agriculture.
11. To develop abilities needed in the boys' farming programs.

Courses to Be Taught

I. Farm-home conveniences:
1. Plumbing
2. Heating
II. Tool repair and maintenance
III. Ropework
IV. Sheet metal
V. Farm machinery repair
VI. Farm forge work
VII. Cold metal work
VIII. Concrete work
IX. Farm drawing
X. Rural electrification
XI. Farm carpentry
XII. Painting
XIII. Glazing
XIV. Harness care and repair.

*Detroit, Mich.

The following table shows the number of days which are to be devoted to the various types of practical work. The season when the work is to be given also is indicated.

	Fall	*Winter*	*Spring*	*Total*
Farm-home conveniences		15		15
Tool repair and maintenance		15		15
Ropework		5		5
Sheet metal			12	12
Farm machinery repair	20			20
Farm forge work		12		12
Cold metal work			6	6
Concrete work	5			5
Farm Drawing	6			6
Rural electrification		10		10
Farm carpentry	24		23	47
Painting			3	3
Glazing			2	2
Harness care and repair		6		6
Tests	2	2	2	6
Vacations	2	2	1	5
Field trips	1		1	2
Movies	1	1	1	3
	61	68	51	180

Based upon a nine months' school year.

I. Farm-Home Conveniences

Objectives:

Develop the ability to appreciate home conveniences; select farm plumbing equipment; install and repair plumbing fixtures; select and install farm water systems; establish farm sewage disposal systems; select, install, and maintain farm heating systems; do ordinary jobs needed in the students' farming program, and to develop a desire for home; develop a desire for home improvement.

Jobs for Study and Discussion:

1. Determine the importance of plumbing on the farm.
2. Develop the plans for a farm plumbing system.
3. How much plumbing should a farmer be able to do?
4. Determine the equipment needed for plumbing jobs on a progressive farm.
5. Make out a bill of materials, showing what pipe, fixtures, fittings, drain traps, and other equipment must be ordered to do a good plumbing job which will meet the state sanitary code.
6. The importance of a farm water supply.
7. Detetrmine the water requirements of a farm.
8. What are the sources of water supply and types of systems?
9. Means of water purification.
10. Calculate the cost of a progressive farm water system.
11. Care of the water system.
12. Importance of sewage disposal.
13. What are the principal parts of a modern sewage plant, and methods of sewage disposal?
14. The common methods of heating farm homes.
15. What are the requirements of a good heating system?
16. Advantages and disadvantages of hot water and hot air heating systems.
17. Types of fuel and heat values of the various types.
18. How heat may be conserved by building construction.
19. The importance of building insulation.

Practical Plumbing Jobs:

1. Install a hot water line.
2. Install a pump.
3. Repair a pump.
4. Install stock tank float.
5. Septic tank.
6. Stock water system.
7. Eaves troughs.

Practical Heating Jobs:

1. Poker
2. Chimney cleaner
3. Ash scoop
4. Splitting wedges
5. Weather strip windows and doors
6. Storm windows
7. Storm doors
8. Home insulating

II. Tool Repair and Maintenance

Objectives:

Develop the ability to do ordinary jobs needed in the students' farming program; appreciate the importance for tool repair and maintenance in a farming program; select proper repair parts; fit tool handles; sharpen farm tools; arrange tools in home-farm workshop; provide for extra replacement parts to be kept on hand; maintain sharp farm working tools; select proper grinding equipment for the farm.

Jobs for Study and Discussion:

1. Determine the importance of tool repair and maintenance on the farm.
2. What grinding equipment is necessary for tool maintenance on the farm.
3. Value of tool orderliness and placement in the home farm shop.

4. How to grind edge tools.
5. Necessity to have extra replacement parts on hand.

Practical Sharpening Jobs:

Sharpen plane knives, knives for the farm, axes, auger bits, saws (crosscut, ripping, and circular), hoes, pickaxes, and grub hoes.

Practical Handle Fitting:

Fit handles to picks, hoes, hammers, chisels, hay forks, manure forks, shovels, axes, scythes, and hand sickle.

III. Ropework

Objectives:

Develop ability to select kinds and sizes of ropes suitable for needs on the farm; splice a rope; set up a block and tackle and use it to best advantage on the farm; make knots, hitches, and slings that are most useful on the farm; make a rope halter; handle and care for rope to obtain the maximum service from it.

Jobs for Study and Discussion:

1. Determine kinds, uses, and care of rope for the farm.
2. Learn about the properties and construction of rope.
3. Find out how rope is sold and the more common sizes.
4. Study the advantages of using pulleys and tackles.
5. Examine the sizes of ropes used on hay forks.
6. Investigate what knots or hitches are most commonly used on the farm.
7. Learn how knots and hitches are made.

Practical Jobs:

1. Rope halter
2. Hay sling
3. Splice rope
4. Replace broken strand
5. Finish rope end
6. Soften rope
7. Lead ropes
8. Assemble block and tackle
9. Replace hay fork rope

IV. Sheet Metal

Objectives:

To develop appreciation of importance of sheet-metal work on the farm; select proper equipment for sheet-metal work commonly done on a progressive farm; do ordinary jobs needed in the boys' farming program; select correct grades of sheet metal for farm repair or construction work.

Jobs for Study and Discussion:

1. Determine equipment necessary for sheet-metal work common to progressive farms.
2. Select grades and sizes of sheet metal for use about the farm.
3. Study methods of developing patterns for making funnels, chimney caps, brooder covers, and the like.
4. Learn how to rivet.
5. Acquire the ability to solder copper, galvanized iron, cast iron, zinc, enamelware, lead pipe.

Practical Jobs:

1. Water trough
2. Chimney caps
3. Brooder cover
4. Cooling vat for milk
5. Water pans
6. Sign
7. Medicine cabinet

V. Farm-Machinery Repair

Objectives:

To develop ability to repair farm machinery; to gain knowledge about farm machines; know how to keep all farm machines in good repair; do needed jobs in connection with the boy's supervised study.

Jobs for Study and Discussion:

1. Determine the importance of farm machinery repair work on the farm.
2. Learn how to adjust and repair a mower.
3. Acquire the ability to dismantle and assemble a mower.
4. Learn how to prepare farm machinery for winter storage.
5. Study the advantages of painting machinery.
6. Investigate the importance of proper lubrication.

Practical Jobs:

1. Mower
2. Drag
3. Disk
4. Tractor
5. Plow
6. Cultivator

VI. Farm Forge Work

Objectives:

Develop appreciation of forge work on the farm; select equipment for forge work on the farm; perform the ordinary jobs needed in the boy's farming program; weld and upset projects needed on the farm.

Jobs for Study and Discussion:

1. Determine the importance of farm forge work.
2. Study the various types of forges for the farm.
3. Select equipment and supplies needed for farm forge work.
4. Locate and place equipment.
5. Study the need of welding on the farm.
6. Learn how to weld.
7. Learn what types of iron and steel are necessary for farm machines and implements.

Practical Jobs:

1. Trailer
2. Hay hook
3. Sign
4. Stove poker
5. Pinch bar
6. Repair broken chain
7. Hog scalding hook
8. Weld tie ring
9. Single tree hook
10. Tree planting bar
11. Single tree hook
12. Double eyebolt

VII. Cold Metal Work

Objectives:

To develop an appreciation of cold metal work as applied to the farm; to learn the terms common to cold metal work for the farm; to do the ordinary jobs needed in the boy's farming program.

Jobs for Study and Discussion:

1. Determine importance of cold metal work.
2. Learn what types of metal are best suited for metal work on the farm.
3. Learn the various methods used for twisting, bending, and fastening.
4. Develop skill in drilling and tapping cold metal.
5. Study the methods of cutting threads on bolts and nuts.
6. Learn what types of bolts are used on the farm.

Practical Jobs:

1. Riveting metal appliances.
2. Tapping a nut.
3. Threading a bolt.
4. Rethreading a battered bolt.
5. Filing a key to fit a lock.
6. Fitting a key into a keyway
7. Rebabbitting a bearing.
8. Redressing a cold chisel or a screw driver.
9. Making and repairing metal appliances.

VIII. Concrete Work

Objectives:

To develop an appreciation of the values of concrete as a practical building material well adapted for a great variety of farm construction needs; test sand for impurities; find out where materials for concrete can be secured; select sand and gravel suitable for concrete mixtures; build forms for ordinary concrete construction on the farm; mix, pour, finish, and cure concrete according to standard recommendations; perform jobs needed in the boy's farming programs; use concrete for some purpose about the farm.

Jobs for Study and Discussion:

1. Determine the importance of concrete on the farm.
2. Study the uses of concrete on a progressive farming program.
3. Learn about the essential qualities of good concrete.
4. Find out what precautions must be taken in selecting materials.
5. Make sand tests for impurities.
6. Select the equipment necessary for mixing and using concrete.
7. Find out where materials for concrete making may be secured.
8. Learn about the recommended mixtures for various types of construction work on the farm.

Practical Jobs:

1. Fence posts
2. Watering trough
3. Septic tank
4. Manure pit
5. Milk-cooling tank
6. Feeding troughs
7. Floor
8. Feeding floor
9. Foundations and walls
10. Milkhouse
11. Foot scraper
12. Building blocks

IX. Farm Drawing

Objectives:

To develop the ability to read blueprints and how to make such drawings as farmers may be called upon to make; make simple sketches and drawings necessary in the boy's supervised farm program; construct a farm project from a working drawing, plan, or print.

Jobs for Study and Discussion:

1. Determine the importance of blueprint reading and making working drawings to a farmer.
2. Learn what symbols are used to represent building materials.

3. Study the importance of using universal symbols in drafting.

Practical Jobs:

1. Sign
2. Wheelbarrow
3. Feed bins
4. Medicine cabinet
5. Milk stool
6. Shoeing toolbox
7. Milkhouse
8. Hot-bed frame
9. Brooder house
10. Candling box
11. Trap nests
12. Dry mash hopper
13. Colony poultry house
14. Self feeder for chicks
15. Drinking troughs
16. Brooder coop
17. Calf stanchions
18. Hay rack
19. Wagon box
20. Orchard ladder
21. Beet rack
22. Seed corn tree
23. Seed tester
24. Crates for potatoes
25. Milk-cooling tanks
26. Stock shipping crate
27. Stanchions
28. Septic tank
29. Loading chute
30. Shed roof type house

X. Rural Electrification

Objectives:

To develop an appreciation for electricity in the farm home; to select wiring equipment, motors, and household appliances wisely; to plan a system of wiring for the entire farm, do the ordinary farm wiring and repair jobs; to use the necessary precautions in doing maintenance work; keep electrical appliances in good condition on the farm; possess a general understanding of how a farm building should be wired; evaluate work done.

Jobs for Study and Discussion:

1. Determine importance of rural electrification.
2. Acquire basic principles of electricity.
3. Learn about the sources of electricity on the farm.
4. Apply the precautions necessary in doing electrical maintenance work.
5. Study the various types of wire, switches, receptacles, appliances, and motors necessary on the farm and in the home.
6. Gather data on the cost of operation and upkeep of a farm power plant.
7. Investigate how to get service to the farm.
8. Study the need of grounding.
9. Determine what electrical work a farmer should do.

Practical Jobs:

1. Electrical brooder
2. Electric fence
3. Check farm buildings for proper wiring and outlets
4. Sign light
5. Shop electrification
6. Automatic light switch
7. Electric hotbed

XI. Farm Carpentry

Objectives:

To develop an appreciation for farm carpentry; to select and care for lumber properly; to select tools for the farm workshop; to read blueprints of farm projects; to construct and repair farm projects; to cut rafters for farm projects; to construct a frame building; to use the framing square; to figure out a bill of material.

Jobs for Study and Discussion:

1. Determine the importance of carpentry work on the farm.
2. Learn how to select farm shop tools.
3. Learn what factors must be considered when purchasing lumber.
4. Plan some practical jobs for the farm shop.
5. Study the importance of knowing how to use the carpenter's square in doing rafter cutting.
6. Find the meanings of the terms: seat cut, plumb cut, span, pitch, run, rise.
7. Study the common types of roofs.

Practical Jobs:

1. Beet rack
2. Corn drying rack
3. Corn crib
4. Potato crate
5. Ensilage rack
6. Hay rack
7. Hotbed frame
8. Orchard ladder
9. Trailer
10. Seed corn storage rack
11. Seed potato cutting rack
12. Wagon box
13. Wagon seat
14. Wheelbarrow
15. Sign
16. Feed bunk for hay
17. Feed bunk for grain
18. Feed or silage cart
19. Stanchions
20. Loading chutes
21. Milk-loading chute
22. Stock-shipping crate
23. Medicine cabinet
24. Harness wash rack
25. Manger and stall partitions
26. Shoeing toolbox
27. Water trough
28. Harness hooks
29. Harness room
30. Feed box
31. Foundation and walls
32. Brooder house
33. Broody coop
34. Brooder coop
35. Doors and window frames
36. Candling box
37. Carrying crates
38. Colony poultry house
39. Wall nests
40. Trap nests
41. Dropping boards
42. Dry mash hopper
43. Dusting boards
44. Grit hopper
45. Feeding trough
46. Running board crates
47. Self feeder for chicks
48. Self feeder for hens
49. Show crate
50. Panels for lambing pens
51. Vegetable forcing box
52. Type A hog house
53. Breeding crates
54. Colony hog house
55. Hog moving crates
56. Knock down hogpen
57. Roughage feed rack
58. Smokehouse
59. Summer shelters
60. Swill chute
61. Trough
62. Shed roof type hog house

XII. Painting

Objectives:

To appreciate the importance of using good paint on the farm; mix and apply paint; prepare surface for painting; apply white wash and calcimine; refinish furniture; do a nest and complete job of refinishing in the farm home; study the composition of paint and calcimine; keep all farm buildings painted.

Jobs for Study and Discussion:

1. Determine the importance of painting on the farm.
2. Find out about the ingredients of paint.
3. What are the values of ready mixed paint; home mixed paint?
4. Study the common types of paint used on the farm.
5. Find out how many square feet of area are covered by one gallon.
6. Learn the proper manner of mixing paints.
7. What forms the skin on paint?
8. Study the types of paint brushes used, and the methods of cleaning them.
9. Why is it so important to prepare the surface before painting?
10. What are the common painting defects?
11. Study the various methods of paint removal.
12. Where is whitewash used?
13. How is whitewashing applied?
14. Study the method of using calcimine.

Practical Paint Jobs:

1. Brooder house
2. Wagon box
3. Trailer
4. House
5. Barn
6. Harness room
7. Wagon seat
8. Sign
9. Medicine kit
10. Milkhouse
11. Manger and stall partitions
12. Orchard ladder
13. Wagon jack
14. Snow plow
15. Farm gate
16. Farm sled
17. Farm machines
18. Fence
19. Foundation walls

Calcimine Jobs:

1. Farm-home interior

Whitewash Jobs:

1. Brooder house interior
2. Hen house interior
3. Barn interior
4. Fence
5. Shed interior

XIII. Glazing

Objectives:

To appreciate importance of glazing on the farm; prepare a sash for fitting and fastening the glass; prepare putty; use putty for glazing windows.

Jobs for Study and Discussion:

1. Determine the importance of glazing on the farm.
2. Learn how to cut glass.
3. Fit and fasten the glass in the sash.

Practical Jobs:

Glaze windows for:

1. Brooder house
2. Dairy barn
3. Hen house
4. Farm home
5. Horse barn

XIV. Harness Care and Repair

Objectives:

To appreciate the importance of harness care and repair; develop the ability to care and repair harnesses; learn the names of harness parts; acquire a knowledge of the various kinds of team hitches; learn how to fit and adjust the harness properly; to develop the ability to clean harness; sew leather; make splices and repairs by stitching; make repairs by riveting; make repairs on leather home equipment; oil the harness.

Jobs for Study and Discussion:

1. Determine the equipment necessary for harness care and repair.
2. Study the types or grades of leather needed for repair work.
3. What are the names of the different parts of a harness?
4. Learn how to make a stitched splice.
5. Determine what type of rivets to use for making a given splice.
6. Study the various methods of attaching snaps and buckles.
7. Learn how to clean a harness properly.
8. Determine method of oiling a harness.
9. Kinds of oil used for harnesses.

Practical Jobs:

1. Harness repair
2. Repair traces
3. Replace hame staples and clips
4. Make a rivet splice
5. Make a stitched splice

Miscellaneous Practical Jobs

Crops
Beet rack
Corn cribs
Corn drying racks
Crates for potatoes
Ensilage rack
Hay hook
Hay rack
Hay sling
Hotbed frame
Orchard ladder
Plant drag
Replace broken rope strand
Replace hay fork rope
Rope splicing
Seed corn storage racks
Seed corn tree
Seed potato cutting rack
Seed roller
Seed tester
Seed treating barret duster
Signs
Soften rope
Trailer
Vegetable forcing box
Wagon box
Wagon seat
Wheelbarrow

Cattle
Calf stanchions
Concrete floors
Cooling vat for milk and cream
Dehorning chute
Feed bins
Feed bunk for hay
Feed bunk for grain
Feed or silage cart
Foot scraper
Hay hook
Hay rack
Loading chute
Manure pit
Medicine cabinet
Milk-loading chute
Milk stool
Milk-cooling tanks
Milkhouse
Rope halter
Septic tank
Stanchions
Stock shipping crate
Trailer
Walks
Water trough

Horses
Feed box
Harness hooks
Harness repairing
Harness room
Harness washing rack
Lead rope
Manger and stall partitions
Rope halters
Shoeing toolbox
Sign
Water trough

Poultry
Brooder coop
Brooder house
Broody coop
Candling box
Carrying crates
Colony poultry house
Door and window frames
Double tier wall nests
Dropping boards
Dry mash hopper
Dusting boards
Electric brooder
Electric sign light
Foundations and walls
Feed box
Feeding trough
Grit hopper
Hopper for green food
Nests for laying house
Oats sprouter
Portable chick brooders
Running board crates
Sign
Self feeder for chicks
Self feeder for hens
Shed roof type house
Stand for drinking fountain
Stand for mash hopper
Show crate
Stove poker
Trailer
Trap nests

Sheep
Drinking troughs
Fence posts
Hay and grain racks
Lamb creep
Loading chutes
Panels for lambing pens
Portable lamb troughs
Salt and mineral box
Shipping crate
Trailer

Swine
A type hog house
Breeding crate
Block and tackle
Building blocks
Colony hog house
Concrete feeding floor
Creep for pigs
Hog hurdles
Hog moving crate
Knock down hogpen
Loading chute
Portable fence panels
Roughage feed rack
Self feeders
Self oiler
Shed roof type hog house
Shipping crate
Smoke house
Summer shelters
Swill chute
Trough
Tripod

Farm
Farm gate
Farm sled
Hand roller
Snowplow
Stone skid
Wagon jack
Wire tightener

Integrating the Related-Subject Teaching in the Vocational School

ANDREW J. MILLER*

It is quite generally recognized that the teaching of related subjects and of the so-called general studies is the weakest part of the vocational training program. This is due, at least partially, to the difficulty of making such instruction functional in character.

In accordance with the regulations governing federally supported vocational schools and classes, one half of the school time must be devoted to shop training, 20 to 30 per cent to the study of related subjects, and the remainder is allotted to the general studies. On the basis of a 30-hour week this time distribution will provide 15 hours of shop training, six to nine hours of related subject instruction, and six to nine hours in the general subjects. Mathematics, science, and drawing are ordinarily classified as related work, and language, social studies, and health education are the subjects usually included in the general studies.

The administrative arrangements and methods for the teaching of related subjects vary in accordance with local conditions. Perhaps the most common method is to have different teachers take care of each of the three subjects of mathematics, science, and drawing. For certification as a related-subject teacher, a person must have received special training in his particular field and must also be able to show evidence of having had "satisfactory trade contacts."

In many of the vocational schools and vocational departments of high schools, the teacher of related mathematics (science or drawing) is usually called upon to teach his particular specialty to a number of different trade groups and not infrequently to mixed classes. Under such conditions it is quite likely that the teacher will not have had any experience in a number of the trades represented in his classes.

The course of study outline is based quite frequently upon the common elements of mathematics (science or drawing) needed in the practice of the different trades or, what is more likely, the work

*Assistant Director, Public Schools, Pittsburgh, Pa.

reduces itself to a review of mathematics beginning with the fundamental operations of arithmetic. To be sure, attempts are sometimes made to adapt the practice problems to the needs of the various trade groups represented in the class.

At best, there is little that can be said in favor of the method of teaching the related subjects in this manner, and much that can be said against it because under such a procedure:

Every pupil is expected to review the subject and this is done quite frequently at the slow pace of the weakest member of the class.

The teaching is not functional either in terms of course content or of time.

There is almost complete absence of integration, each of the related subjects being taught independently and without any reference to the others.

The old time-worn academic approach is employed. There is no reason to believe that pupils who failed to acquire the fundamentals of mathematics (science or drawing) up to this time will be able to do so now unless the work is presented in such a way as to have real functional value for them.

A great deal of time is wasted since much of the material is not of functional value in the practice of the trade.

It is the writer's conviction that the teaching of related subjects may be greatly improved by what might be called, for want of a better term, the integrated approach. Briefly, the integrated approach means: (1) that all of the related subjects are taught by one teacher and (2) that the relative amount of time devoted to each of the related subjects is controlled entirely by the functional needs of the trade. The organization of an integrated course may perhaps be best explained through an example, which, in this case has been chosen from the carpentry trade.

Since the house carpenter carries on his work in accordance with a set of plans and specifications, such a set of plans and specifications should form the core around which the related subject course of instruction is built. Under this plan each pupil is given a complete set of plans and specifications for a two-story house of, say, six or eight rooms. No two of these plans are exactly alike. Individual instruction sheets covering sequential phases of the work are also provided for the use of the pupil.

As a more specific example let us take the problem or job or assignment of determining the material needed and the length of the various members of the "plate." The plan for the basement of a house is shown in Figure 1 and that portion of the specifications having to do with the plate reads as follows:

"The house is of brick veneer construction.

"A plate of 2 by 6-in. material is to be laid on top of the foundation wall.

"After the sill and joists for the first floor have been framed, the floor structure is to be made true and level. The plate is now to be wedged snug against the underside of sill and joists, and any space between the top of the wall and the sill is to be filled with cement mortar."

The solution of this assignment by the pupil is shown in Figure 2. The work was done in accordance with the directions contained in an individual instruction sheet entitled "How to Lay Out and Determine the Length of the Various Members of the Plate." In this instruction sheet the mathematics, science, and drawing elements of the problem are treated in an integrated fashion. Accordingly the instruction sheet contains directions for and a thorough discussion of the making of the sketch, the determination of the length of the various members of the plate, the functional value of the plate, the need of having the plate rest firmly upon the foundation wall, and other pertinent problems.

The question might be raised as to the amount of formal mathematics that needs to be taught under the procedure just described. The answer to this question is *none unless such instruction is needed.* In other words, if a learner is able to carry out all of the calculations involved in this particular assignment, no formal mathe-

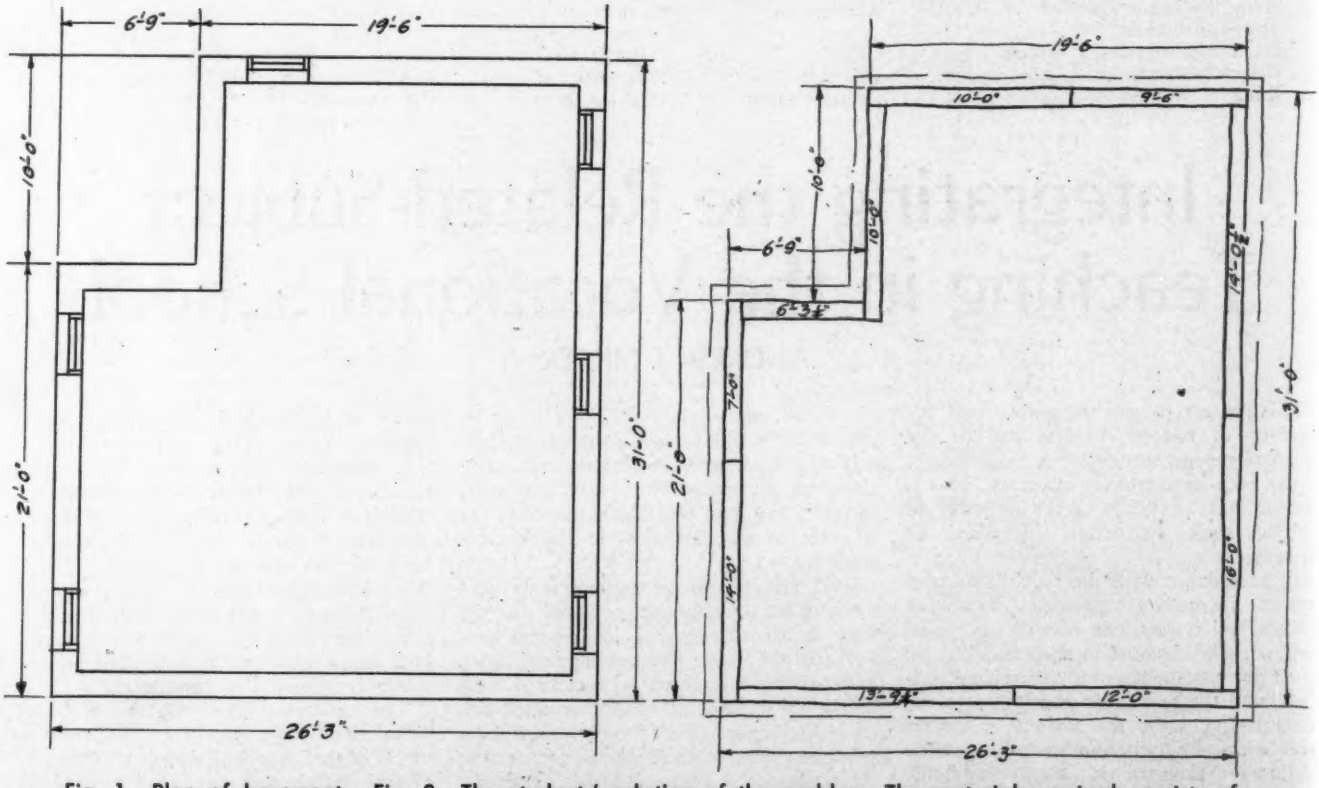


Fig. 1. Plan of basement. Fig. 2. The students' solution of the problem. The material required consists of: 3 pc., 2 by 6 by 10 ft.; 1 pc., 2 by 6 by 12 ft.; 4 pc., 2 by 6 by 14 ft.; 1 pc., 2 by 6 by 16 ft.

matics teaching is needed. On the other hand, those pupils who may run into difficulties due to their inability to add or subtract quantities involving inches and feet are given the necessary instruction. Such instruction is given through the use of an individual instruction sheet covering this particular part of mathematics. Similarly, if a pupil is not able to make the sketch or drawing necessary for the completion of this assignment, special help is provided through an individual instruction sheet. It will be seen that under this scheme all elements of mathematics, science, and drawing entering into the solution of this problem are treated as one integral whole, and at the time they are needed; thus getting away from the usual compartmentalization of these subjects.

Someone has suggested that in order to make the related teaching really functional it should be taught in connection with shopwork and by the shop teacher. If the shop teacher is fully qualified and recognizes the importance of the informational as well as the skilled side of the trade, such an arrangement should provide a well-integrated course, assuming, of course, that the shop teacher is equally well qualified to teach the fundamental elements of mathematics, science, and drawing which are of direct functional value in the trade, and assuming also that his schedule will allow him to devote the extra time necessary for the teaching of the related phases of the trade.

To summarize: The advantages of the integrated approach to the teaching of related subjects are:

1. That it will not only make the related teaching functional in character but that it will limit the related subject course content to the strictly functional elements of each related subject.
2. That it prevents the compartmentalization of subject matter.
3. That it makes it possible to cover all the important phases of related teaching.
4. That it provides for the individual needs of the pupils.
5. That it saves time and opens the way to a better-balanced program of related and general instruction.

It has been stated that the teaching of related subjects and of the general studies was the weakest part of the day vocational training program, and the lack of functionality in the teaching of related subjects has also been discussed. A similar charge may also be made against this phase of teaching in the cosmopolitan high school.

Since the preservation of democracy demands intelligent, enlightened, and physically well-developed citizens, and since the general studies (language, social studies, and health education) have an important contribution to make in this direction, it is essential that sufficient time be allotted to these subjects in the school program. At the present time, from 6 to 9 hours of a 30-hour week are available for the general studies, and most vocational schools are probably devoting 6 rather than 9 hours to these subjects. It is the writer's conviction that with the integrated approach 6 hours will be more than sufficient in most trades to cover all the functionally related phases of the work. Such an arrangement will make it possible to devote 9 hours to the general studies. Thus, by the integration of the related subjects and the functionalization of both related and general subject matter, a better-balanced vocational program will be possible.

Check List of Personnel Duties

SAM HITCHCOCK*

This check list was developed at a state meeting called for local supervisors of war-production training. It was felt that a better job of supervision could be done by local supervisors if they were given a definite check list. In order to check the quality of instruction in a given school, the supervisor is asked to fill out a check list for each shop instructor in that school.

The check list was worked out by local supervisors of Wyoming.

*State Director of Vocational Education, Cheyenne, Wyo.

Chart Showing Who Is to Perform Given Duties

Duties	*Supervisor*	*Clerk*	*Instructor*	*Toolroom Checker*
1. See that instructors are ready**	X			
2. Check progress of instructors	X			
3. Check toolroom keeper	X			
4. Check janitor and his work	X			
5. Cooperate with school board and superintendent	X			
6. Meet with advisory committee	X			
7. Contact *uses*	X			
8. Contacts for war contracts	X			
9. Contacts for Army personnel training	X			
10. Conducting visitors through shops	X			
11. Making up priority applications	X	X		
12. Contacting salesman	X		X	
13. Observe trainee activity**	X			
14. Writing letters	X	X		
15. Making up budget	X	X		
16. Get and check instructors' applications	X			
17. Interview for employment	X			
18. Train new instructors**	X			
19. J.I.T. training**	X			
20. Read bulletins	X			
21. Deal with families	X		X	
22. Check quality of instruction**	X			
23. Improve quality of instruction**	X			
24. Hire personnel	X			
25. Follow up on students	X			
26. Custom work policy	X			
27. Labor relations	X			
28. Final authority disputes	X			
29. Making requisitions and purchases	X	X		
30. Check attendance		X		
31. See that instructors are present		X		
32. Register new students		X		
33. Check roll for dropouts		X		
34. Check student hours		X		
35. Making up state reporting forms		X		
36. Making up 114's for placement		X		
37. Making up forms 2 and 3		X		
38. Answering mail		X		
39. Answering phone		X		
40. See that machines are in shape			X	
41. See that supplies are available			X	

***Improvement of Teaching Jobs.*

Duties	Supervisor	Clerk	Instructor	Toolroom Checker
42. Check students' progress			X	
43. Check inventory EI			X	
44. Sending test plates			X	
45. Planning installation and arrangement of machinery			X	
46. Build tools and equipment			X	
47. Adviser to students			X	
48. Write letters of recommendation			X	
49. Invoice equipment and supplies				X
50. Run down tools				X
51. Mark tools				X
52. Assign responsibility for above jobs	X			

Report Sheet for War-Production Training Classes

R. J. KING*

The report sheet shown and described herewith was originated in the Saline County Vocational School to meet an urgent need for some medium of expediting the supervising of war-production training instructors.

A report is made daily by each instructor in charge of a vocational training class. The supervisor, before making a routine visit to a class, can quickly run through the reports, gather what data is needed, and order disposition of the information as he sees proper.

It is sometimes impossible for a supervisor to make daily visits to all classes, and the report can serve as an absentee supervisor. Also, many small but time-killing factors can be handled through these reports, thus saving time that can be better spent in personal counseling with the instructors.

The reports can be filed and become a part of the record system to be used as reference when the need arises.

This report was designed for use in a school for training war-production workers; however, with slight modifications, it can be made to fit the needs of other types of training school programs.

The form can be easily run off on a duplicating or mimeograph machine at little cost.

Some of the advantages arising from its use are:

1. Keeps a daily and accumulative record of each class.
2. Easy to obtain record of attendance, new enrollees, and withdrawals.
3. Can be used as a check on class progress.
4. Record of materials used for inventory purposes.
5. Designates where and how materials are obtained and used.
6. Daily requisition.
7. Records personal questions and statements from instructors that otherwise might be forgotten or overlooked.
8. Gives instructors a responsibility that tends to keep them *up with their job.*
9. Saves valuable time for supervisors.
10. Valuable as a reference for information.

*Saline County Vocational School, Harrisburg, Ill.

Saline County Vocational School

Information Sheet

Department Welding Instructor Brook
Date Jan 5, 1942 Hours 6:00 P.M. - 9:00 P.M.

Student Absence	Hours Missed	Reason
John Doe	6:00 P.M. - 9:00 P.M.	Unknown
Frank Towns	6:00 P.M. - 7:00 P.M.	Car Trouble
Henry Howe	6:00 P.M. - 9:00 P.M.	Ill
William Keller	8:00 P.M. - 9:00 P.M.	Left early (with Doc)

New Enrollment Name	Hours	New or Transfer
Michael Neu	6:00 P.M. - 9:00 P.M.	New
Clarence White	6:00 P.M. - 9:00 P.M.	Transfer from 1:00 - 12:00 Class in welding

Withdrawals Name	Date	Reason
Guy Jones	Jan 4, 1942	Private employment as arc welder's helper at Black's Welding Shop

Type of work done in shop instruction period
Bottom instruction - Demonstrated method of arc welding - Repaired arc welding machine and placed back in operation.

Materials used during shop instruction period
5 lbs 1/8" No 7 - 3 lbs 3/16" Mucop - 4 lbs 5/32" Ventop
2 ft 3" pipe - 5 lbs 1/2" scrap

Materials borrowed
One colored arc weld key from High School Department
Case flints for flint lighter from Mfg. Co.

Requisition
1/2 dozen 4 1/2 x 2 colored arc welding leads
Case dozen flints for flint lighter
12 tanks oxygen
4 tanks acetylene

Remarks
Recommended dismissal of Joe Brown on basis of extremely poor eyesight. Need one more trainee for arc welding station.
Scrap iron supply getting low.

A Student-Kept Time Card

WILLIAM BECKER*

In many industrial plants, offices, engineering departments, test rooms, etc., employees keep a time record. Such a time check allows the pay clerk to check on the working time, regular and overtime, and more important, allows charging to the proper expense account, the time of all employees.

Anyone can see the need for a time card in the case of the repairman such as a plumber, electrician, or radio repairman who must charge his time after a piece of work is done. In the school shops, on the industrial-arts or vocational level, generally all records are kept by the instructor. Frequently neither instructor nor student is checking whether the time spent in the shop is efficiently and effectively used. In fact, most will admit that much time is wasted by some boys in the school shop. Some boys do not realize this until the end of the marking period when, with little work to show for the time spent, their record is poor.

Time is important. This is especially apparent today where the most important single item in our war-production effort is — time. To impress the student with the value of time, it is well to require him to keep a record of his own time. The form shown herewith has been used quite effectively in our school shop for several years. It has been found that it gives the boy a better appreciation of what time means. Each boy reports his time every two weeks, and it gives him an excellent picture of how much of it he spends on the various jobs. In marking the report card of each boy at the end of the semester, boy and instructor have before them both the time report of the student and the conventional project marks. It is obvious to any boy, after looking at the record which he has kept himself, just how much his rating is worth from the standpoint of time spent on each job. Naturally, one spending too much time on a job cannot be rated as high as one who finishes a number of similar jobs. Students can see this for themselves whereas the customary summary mark on the part of the instructor, which usually does not point out the value of time to the boys, may not be appreciated by some boys who believe the completion of one or two jobs is sufficient.

Although the time report card shown is self-explanatory, a few explanations may be in order. The report period listed under *Date of Report* should be regular, probably every week or two. It is a good idea to have

YOUR TIME REPORT

Name

Date of Report	Projects worked on this report 1	Number Days	2	Number Days	3	Number Days	Number make-up days	Days absent this report	Number days included in this report	Total days from beginning of term

ONLY, when a project is finished, list it here

Name of Project	Total days to build job	Name of Project	Total days to build job	Name of Project	Total days to build job
1.		5.		9.	
2.		6.		10.	
3.		7.		11.	
4.		8.		12.	

a regular report time in which all students check up their time and turn in their time reports. On the same horizontal line with the report date, the students charge the number of days spent on each job to that job, the number of make-up days, and the days absent. The total should add to the figure given by the instructor under *Number of days included in this report*. Obviously, the number of *Total days from beginning of term* will accumulate with each report date. Probably the most important part of the report is the lower portion where the student tabulates the time spent on each job. When each job is finished he totals the number of days spent and lists it. It is this information which shows whether or not time is being wasted.

*Supervisor of Vocational Rehabilitation, State Education Department, Albany, N. Y.

School-Shop Safety

H. W. SCHMIDT*

The matter of safety education is at last receiving deserved attention at the hands of school authorities in an increasing ratio. As a rule both educator and layman consider the schools as perfectly safe areas and pupils subject to accidents only on the playground, the football field, or on the basketball floor. But recent studies and statistics show the fallacy of this thought. A study of a few years ago showed that of all reported accidents to school children nearly 36 per cent occurred in the school plants and about 19 per cent within the buildings themselves. Of the latter, gymnasium, corridors, and stairs carry off the dubious honors of greatest numbers. Classrooms and shops just about split even with about 14 to 15 per cent each.

As the topic heading gives a key to the contents of this brief article let us just scan the distribution of shop accidents as collated from various sources. In the woodshops, the hand tools carry off the palm with the versatile chisel heading the list; the machine accidents center around the saws and the shaper as may be expected. In the machine shop the hack saw and the hammer seem favorite weapons while the lathe tops the list of machines, trailed by the grinder. The auto shop has the wrench and hammer vying with each other while the gasoline engine just about doubles the accidents caused by the other two. The electrical shop sections confine themselves to the knife, screw driver, and soldering iron as *lethal* weapons. The ubiquitous grinder accounts for a good many accidents, and in the other activities the thumb and finger hitting hammer again forges to the front. The welding shops seem fairly free from accidents with the exception of incidental burns; the same is true of the forge and foundry sections.

If we now analyze these statements we find, interestingly enough, that apparently most if not all accidents are due to *personal* causes, such as failure to heed instruction, plain carelessness, inattention, improper use of hands, abuse or misuse of equipment, foolery, inexperience, and the like.

(Continued on page 20A)

*Supervisor, School Building Service, Madison, Wis.

Camouflage ·· —— —— Principles ··

CAMOUFLAGE ·· IS TO CONCEAL OR TO DECEIVE · THE CAMOUFLEUR IS ONE WHO PRACTICES THE ART OF CAMOUFLAGE TO PROTECT INDUSTRY, LIFE AND PROPERTY; APPLIED TO EXISTING BUILDINGS AND TO NEW STRUCTURES

FACTORS THAT CONTRAST WITH SURROUNDINGS PERMIT VISIBILITY ·

THESE ELEMENTS PERMIT RECOGNITION

COLORS RELIEFS TEXTURES SHADOWS

ARE COUNTERACTED BY

BLENDING PATTERN IMITATION DISTORTION

MASSES CONTOURS

ARE CONFUSED BY

CHANGING THE OBJECT'S SURFACE · · DISTORTING THE OBJECT'S OUTLINE

· AIMS ·

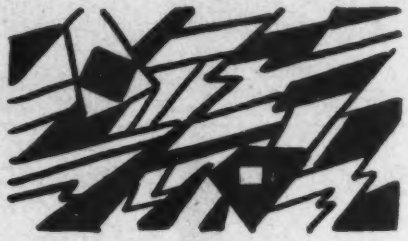
WE WANT THE TARGET TO BE DIFFICULT TO FIND, DIFFICULT TO HIT AND UNPROFITABLE TO BOMB · OBVIOUS LANDMARKS AND TARGETS NEED TO BE CAMOUFLAGED

Plate 1. Camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

Camouflage — Conspicuousness

REFLECTIONS, SHADOWS, CIRCULAR FORMS, REGULAR FORMS AND STRAIGHT LINES STAND OUT CONSPICUOUSLY ON VERTICAL AERIAL VIEWS. TEACHER AND STUDENT SHOULD COLLECT PHOTOGRAPHS FOR ANALYSIS.

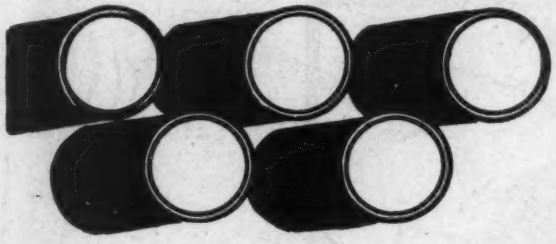
THE EYE READILY SPOTS ROUND FORMS SURROUNDED BY PATTERN



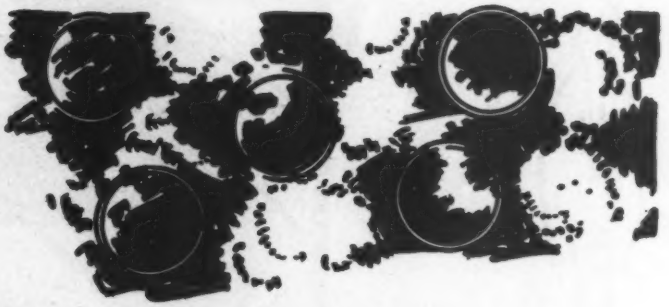
REGULAR FORMS ARE CONSPICUOUS AMONG IRREGULAR

STRAIGHT ANGULAR LINES STAND OUT AGAINST PATTERN

LOOK FOR EXAMPLES OF PROTECTIVE CAMOUFLAGE IN NATURE. SHE BLENDS HER COLOR AND PATTERN TO CONFUSE THE OBSERVER.

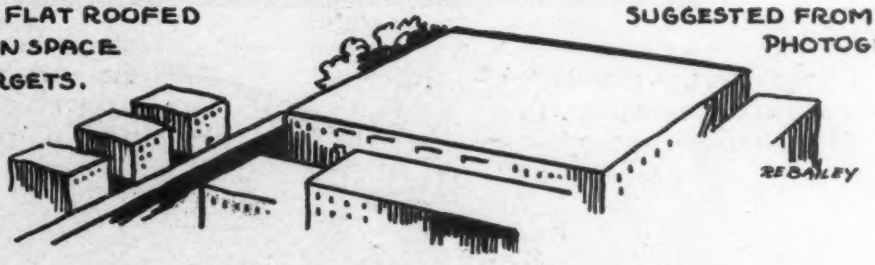


CONGESTED, VISIBLE, AND VULNERABLE TO ATTACK



CONFUSING, LESS VISIBLE, LESS VULNERABLE, AND EASILY CONCEALED

LARGE, CONGESTED, FLAT ROOFED BUILDINGS IN AN OPEN SPACE ARE EXCELLENT TARGETS.



SUGGESTED FROM ACTUAL PHOTOGRAPH

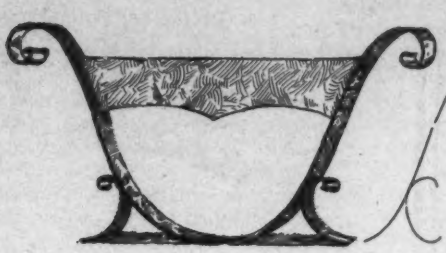
Plate 2. Continuation of camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

PLATE 9 BIRDS

THESE SKETCHES MAY BE USED FOR REFERENCE BUT
THE STUDENT SHOULD MAKE STUDIES DIRECT FROM
NATURE TO DEVELOP ORIGINALITY. KNOWLEDGE COUPLED WITH
IMAGINATION LAYS THE FOUNDATION TO CREATE

Plate 9. Creative design course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

HOW CAN THE DESIGNER USE WROUGHT IRON?



Shoe Scraper

Key Plate

Stag Hinge

1. By giving it fine contour lines. S- and C-curves are commonly used in wrought-iron work.

2. By producing a well-planished surface. The normal process of production of fine iron work calls for the use of stock slightly over the finished size. Reducing, square-to-octagon-to-round-etc., improves the metal, and leaves the surface covered with the honest evidence of construction. A final planishing with a slightly curved hammer face leaves a surface almost as smooth as skill can produce. This surface is one of the chief design elements.

One of a Pair of Andirons

Well-Planished Surface

Avoid exaggerated or useless hammer marks that can only indicate poor workmanship.

3. By indicating clearly and frankly the methods of joining parts.

Welding

End of Curtain Rod

Banding

Tile-top Table (Guido)

Riveting

Shutter Catch

Plate 14. Continuation of design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

WROUGHT IRON (Continued)

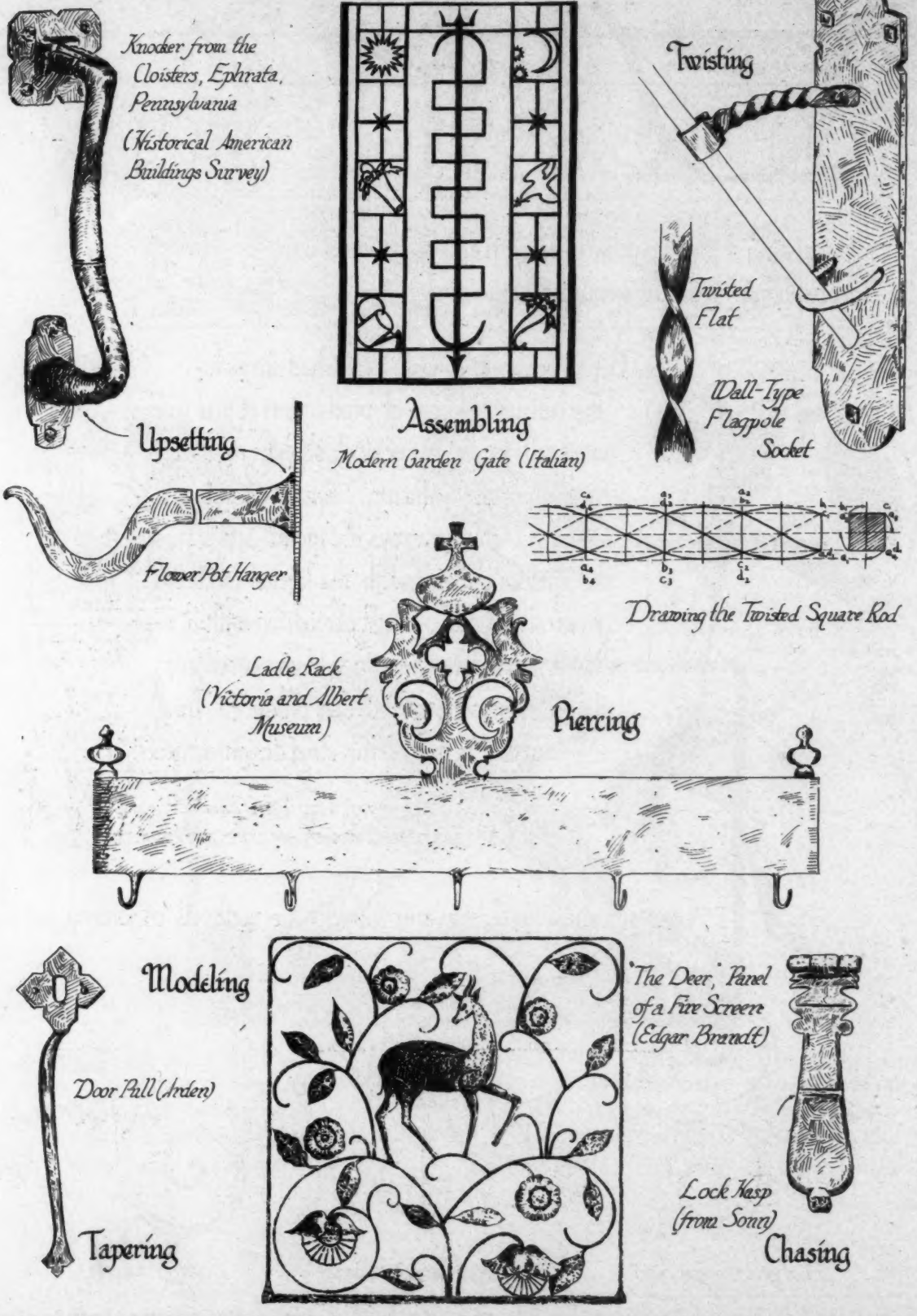


Plate 15. Design course by Burl N. Orburn, director of industrial arts, State Teachers College, Millersville, Pa.

A STUDENT WANTED

A student for hard work and rapid promotions who can find things to be done without the help of teachers or supervisors. A student who gets to classes on time and does not imperil the lives of others in an attempt to be first out of the classroom. A student who listens carefully when spoken to, and asks only enough questions to insure accuracy in carrying out instructions. A student who moves quickly and makes as little noise about it as possible. A student who looks you straight in the eye and tells the truth every time. A student who does not pity himself for having to dig in and hustle. A student who is cheerful, courteous to everyone, and determined to make good. If interested, apply any time, to any teacher, in any classroom, anywhere.

— Elmer E. Clausen, Kenosha, Wis.

The establishment of ideals in the minds of pupils is one of the first duties of the teacher; the finished project measures how well the ideal was established. An ideal thus achieved helps to build up still higher ideals in the future and the process never ends.

— *Wm. L. Hunter*

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN HUNT, Hales Corners, Wis.

(Continued from page 80 of the February, 1943, issue)

Grizzly Bear

The grizzly bear shown in Figures 112, 113, 114, and 115, presents a real problem to the whittler. The job may look simple, but it embodies quite a bit of undercutting which makes it rather difficult. Figure 112 shows five different views to work from. Study these views, and the half tone carefully before you begin to whittle. As the grain runs up and down, most of the cutting will be across the grain. This means that the knife must be razor sharp. A small crooked knife will come in mighty handy on this job. Get a nice soft piece of white pine, cotton wood, or poplar, to work on.

To start, draw or trace one of the side views onto the block of wood and cut out the silhouette on a band or jig saw. See Figure 113. Then bore holes between the legs as shown in Figure 113. This is easier than trying to saw out these openings, and will produce the shape just as well.

The next step is to block out the legs and head as shown in Figure 114. If these simple directions are followed, it will be a lot easier than trying to whittle out the rounded shape from the start. After the legs are separated and the head squared in, start rounding up gradually. A long, thin bladed knife will be found best for cutting out beneath the body and around the legs. Take off a little at a time, or the knife blade may be broken off.

After having whittled out the grizzly, the next question is how to finish it. We found it looked better to leave nice clean knife cuts than to try to make the grizzly's hide look like fur. So, after the bear looks just about as you want it, go over the whole thing again with a razor edged knife, making small clean cuts. Then sandpaper the face and ears a little just to smooth them up. Do not sand the entire bear because then it will look as though it were skinned.

After having gone over the entire bear as suggested, it may be stained with a yellowish brown stain or water color. Stain the base gray. Do not use oil stain, as the predominance of end grain will make it too dark. After the stain is dry, wax and polish the figure.

Fig. 115. The finished grizzly

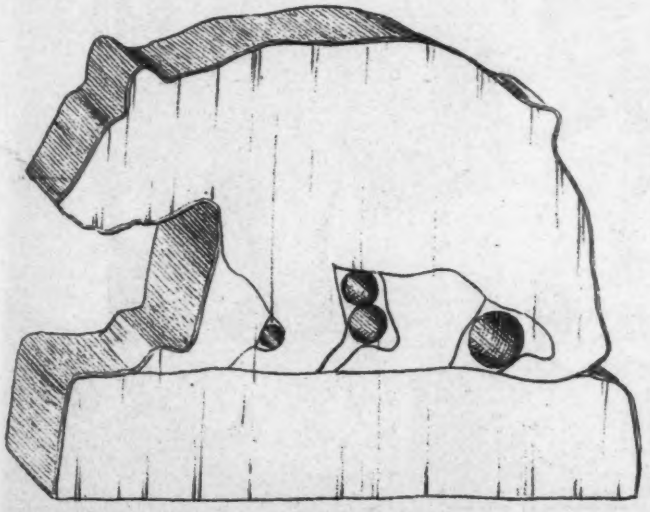


Fig. 113. Cutting out the silhouette

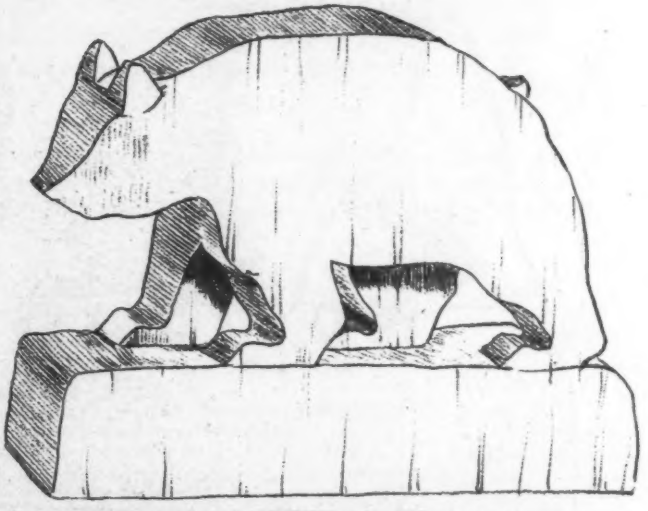


Fig. 114. Blocking out the head and legs

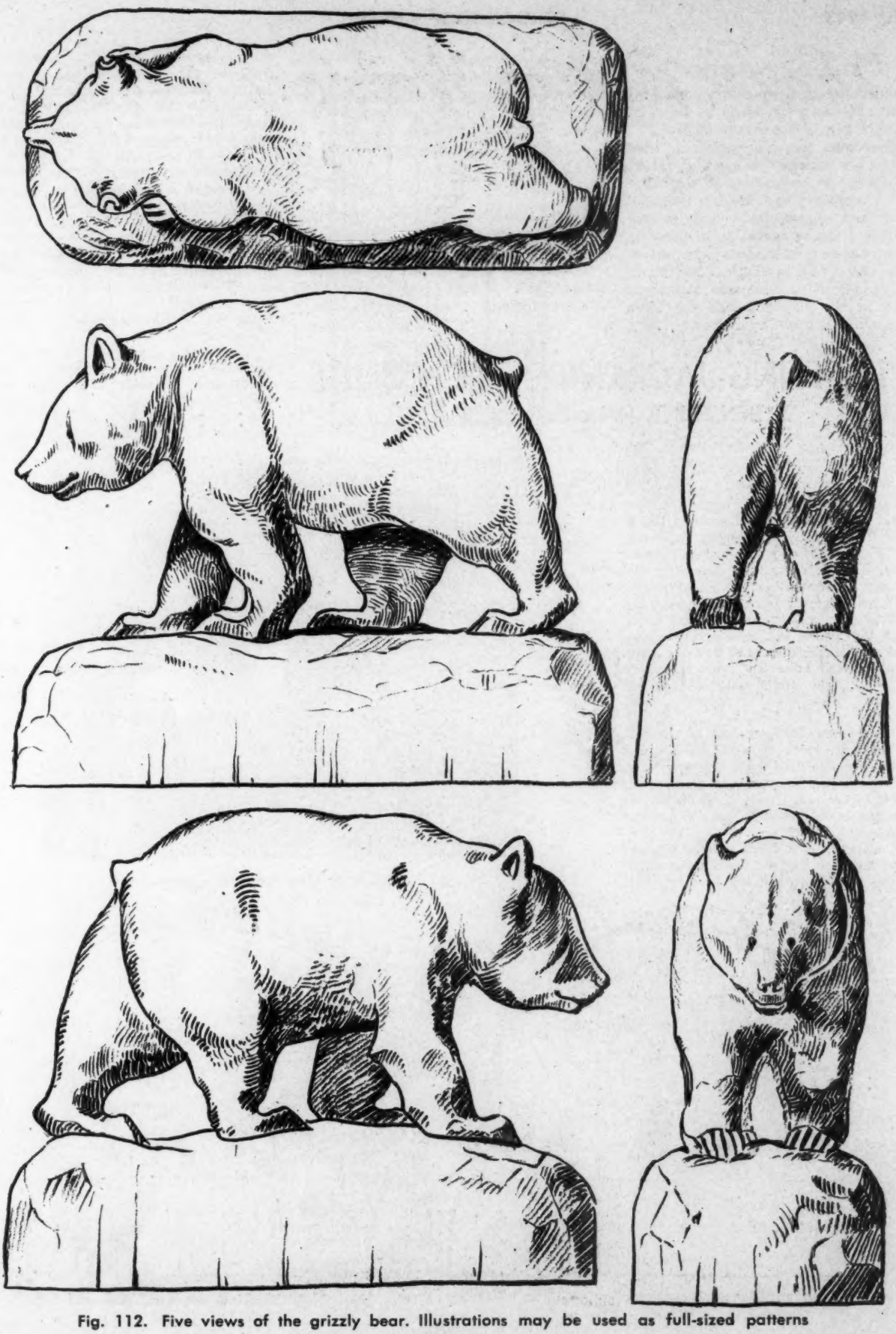


Fig. 112. Five views of the grizzly bear. Illustrations may be used as full-sized patterns

Train Better Welders Faster with these Airco Instruction Books

OXYACETYLENE WELDING & CUTTING

Vol. 1, Lectures. Introduces the student to fundamental gas welding methods. It explains the design and operation of welding and cutting torches, tips and regulators and describes properties of various metals as well as practical welding methods used in industry. **Vol. 2, Exercises,** presents a series of carefully planned exercises that help the student to quickly learn practical methods for welding the most commonly used metals. Each volume is bound in a hard cover. Price $1.00 per copy.

ARC WELDING

Vol. 1, Lectures. Acquaints the student with fundamentals of electricity, its application to welding, and the operation of welding machines. **Vol. 2, Exercises** begins with the basic operation of striking an arc and covers welding with all types of electrodes. Standard tests are included to help the instructor determine the student's progress. Bound in a hard cover. Price $1.00 per copy.

INSTRUCTIONS IN AIRCRAFT WELDING (*Oxyacetylene*)

This volume provides a well-planned series of workroom exercises that demonstrate the specialized techniques used in oxyacetylene welding for the aviation industry. Its 36 pages are profusely illustrated to show clearly proper torch manipulation, application of filler metal, and methods for making all types of welds used in aircraft fabrication.

Price $.50.

Free inspection privileges are provided for each of the above books. Special discounts to teachers on single copies, and quantity discounts for students. Write to Air Reduction, Advertising Department, 60 East 42nd St., New York.

Air Reduction

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS:
MAGNOLIA-AIRCO GAS PRODUCTS CO.
General Offices: HOUSTON, TEXAS
OFFICES IN ALL PRINCIPAL CITIES

AIRCO WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

SCHOOL-SHOP SAFETY

(Continued from page 135)

A specific study shows that very few accidents are due to defective machinery or lack of instruction — in other words, virtually most accidents are *functional* ones, using the term for want of a better one. Of course, machines have their weak spots but the safety movement the country over has had its reflex in terms of safe machinery. Add to this the stand taken by regulatory state authorities and we have a rather good setup as a whole, especially so far as industry is concerned. But there is still plenty of room for improvement and the school shop is no exception. So let us do a little scouting around and look over our shops in the interest of safety.

With all the plans published and the literature on the subject, it may seem futile to call attention to some things rather obvious to many, but shop visits will show that betterment is possible.

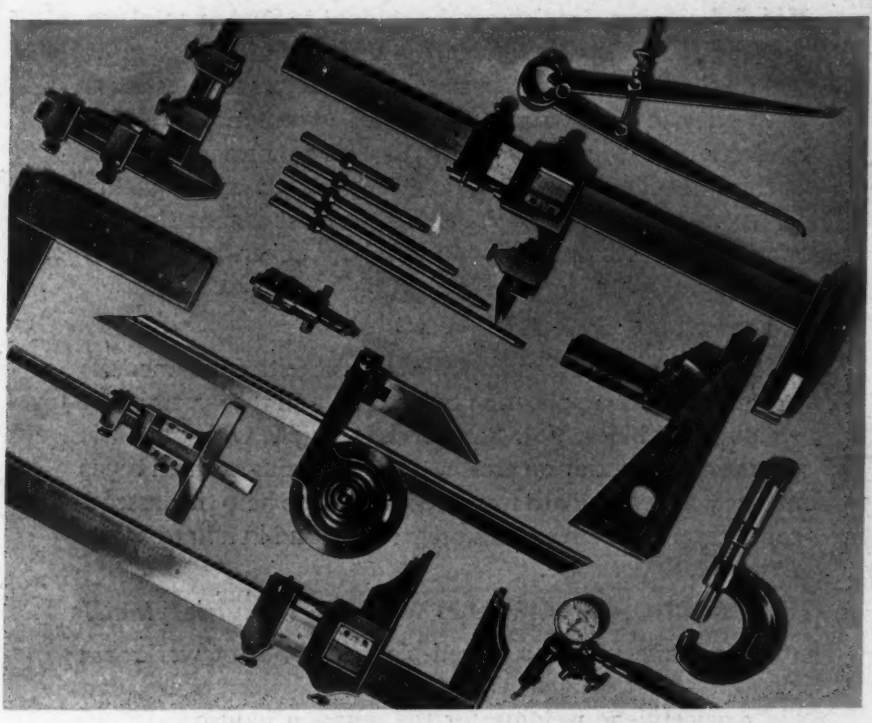
How about placing machines so that the natural and artificial light does not fall upon the business end and the operator stands within his own shadow? How long a board may be ripped or crosscut without interfering with other machines, or devices, or working students? Is a supplementary stand available for long stock or will the sagging material pinch the saw? Are non-slip floor mats provided on machines where the operator is dependent upon a firm footing? Are push sticks for the saw or jointer available, and are guards, splitters, and back-kick dogs installed? Are the benches arranged to allow ample work space or does the student have to do some *butting* to gain space? A woodworking shop of any size should be provided with a shaving and dust exhauster. Are all the belts protected and gears covered? Are all saws covered, jointers guarded, shapers protected? Is the band saw protected and the front saw guard in place? Do you permit the boys to work around machines without proper clothing? Are loose sleeves and ties in evidence?

Self-contained motor-driven machines will need to be grounded not only so far as the motor is concerned but the machine as a whole, particularly high-speed machines which develop a comparatively high-voltage *frictional electricity* which can give a shock heavy enough to lead to accident. Is all wiring suitably metal clad or are cords dangling around, twisted about nail supports, or looped over metal parts? Where portable machines are found they may be either 115 or 230 volts. Plugs for these two voltages should not be interchangeable and different receptacles should be used for each of these two voltages. Cords for these machines should be heavy duty rubber covered and not the flimsy cotton covered ones found so frequently. It is hoped the open switch is no longer with us but it is only a hope because they are found. We also still find panel boards and fuse panels in wood cabinets; these should be gotten rid of as soon as possible and replaced with steel and *dead fronts*.

How about the auto-mechanics shop? Are exhaust gases permitted to escape into it or are exhaust hoses provided? Is the crane or hoist so installed and located that the travel or swing is limited to prevent accidents or running off the track? Is plenty of ventilation assured? Are machines and motors and autos so disposed that plenty of work space is available? Too often such shops are full of plain junk, crammed into all kinds of spaces. Is the floor kept free of materials? Falls due to oil on the floor may be extremely dangerous. How about gasoline? Is it spilled or is an unusual amount on hand? Five gallons, in red containers, is the usual limit and that is frequently too much.

Are the grinders located to handle long stock at times? Are they provided with safety glass shields or are goggles provided and insistance placed upon their being worn? Are there wheel guards installed? Of course, grinding wheels never break — *until they do!* Where shafting, belts, and

(Continued on page 22A)



STARRETT TOOLS

ARE STILL STANDARD FOR ACCURACY

The makers of Starrett Tools are working night and day to supply the enormous demand for the precision measuring tools that are vitally important to the winning of this mechanized war.

If you have experienced delays and difficulties in obtaining the tools you need you will know that it is because the production of such fine tools cannot be expanded at the expense of Starrett accuracy and quality of workmanship.

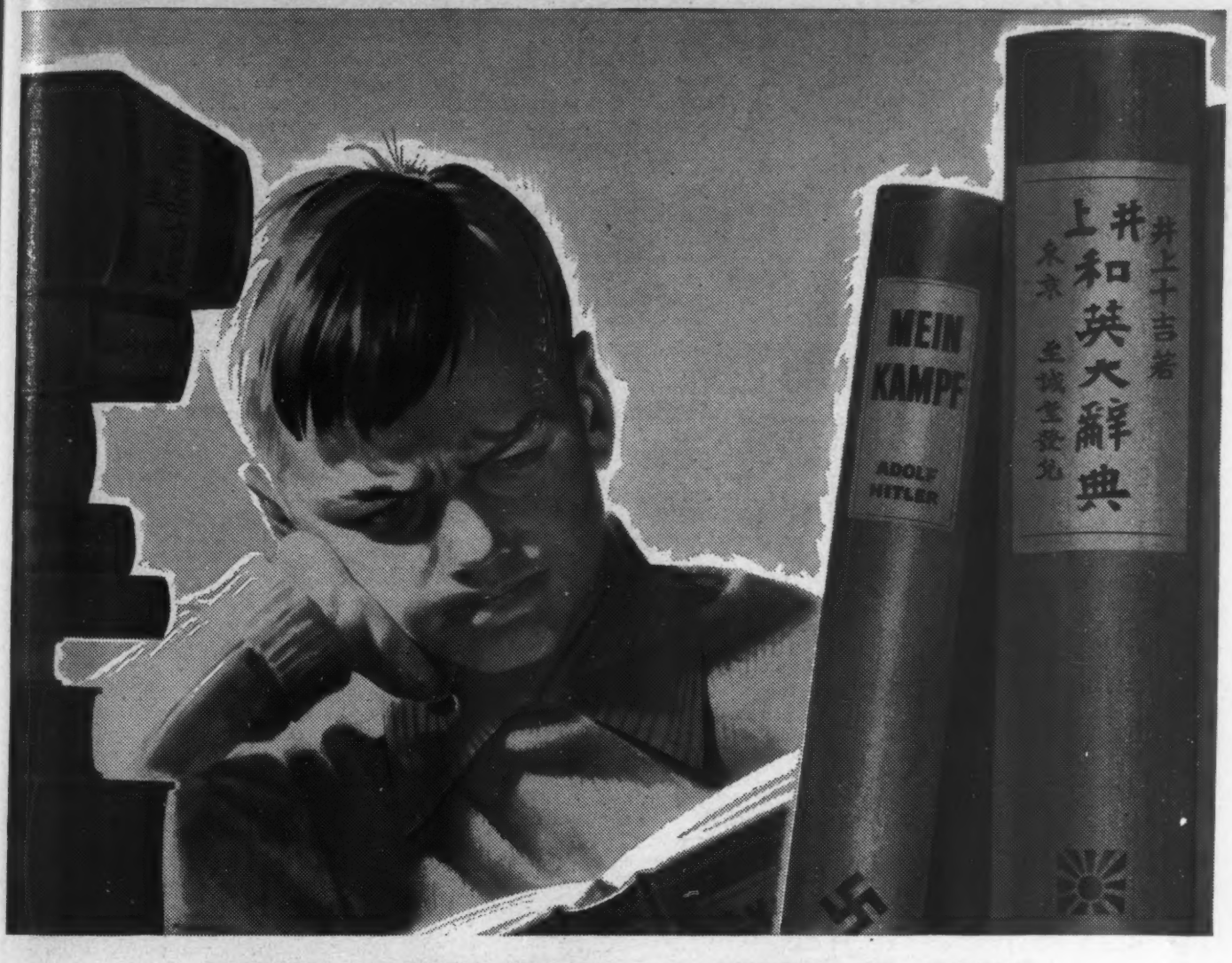
Your understanding and cooperation is sincerely appreciated by

THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U. S. A.

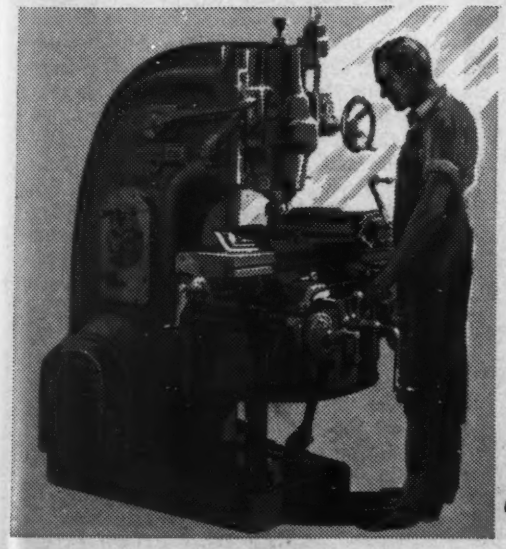
World's Greatest Toolmakers

STARRETT TOOLS

Precision Tools... Dial Indicators... Ground Flat Stock... Hacksaws... Metal Cutting Band Saws... Steel Tapes



YOU'LL NEVER HAVE TO STUDY IT, SON!



No, lad, your "homework" won't include any of these strange, foreign, unwholesome teachings . . . all of us are fighting to make sure of that.

You're proud to be an American and we are seeing to it that you can always hold your head high. Millions of Americans are working together — on the battle front and on the production front — to assure a decent world now and a better world when you are grown up.

And while we are working and fighting, we're learning, too — learning how to make a lot of things better with light metals and plastics and chemicals — designing and building machines that will not only provide more of the good things of life but will also mean jobs for the fathers of boys like you — and for you, too, when the time comes.

That's really the reason why all of us at Kearney & Trecker are doing all we can — building the machine tools that are needed to make the weapons to win the war.

Yes, son, it will be a better, brighter world when our fight is won.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

"Buy Victory with War Bonds"

Milwaukee MACHINE TOOLS

SCHOOL-SHOP SAFETY

(Continued from page 20A)

pulleys are used, are safety collars in evidence, are safety setscrews used, and are the belts of the endless type? Belt lacing and protruding setscrews are often deadly engines of destruction.

Welding and spray booths, of course, must be provided with exhausters, and the work tops in these booths must be of incombustible materials as must also be the sides of the booths. Welders' helmets, gloves, goggles, and the like must be furnished as a matter of course.

On the hand-tool side we are confronted with the omnipresent hammer and chisel as the most accident prone, with the screw driver and wrench a good second group. Here little can be done except careful instruction how to use these instruments of torture and infection and then see to it that these instructions are *obeyed*. How often do you see a hand placed ahead of the business end of a chisel; and the same is true of other sharp-edged tools, and statistics show that fingers and hands suffer through improper handling of the universal tool, the hammer.

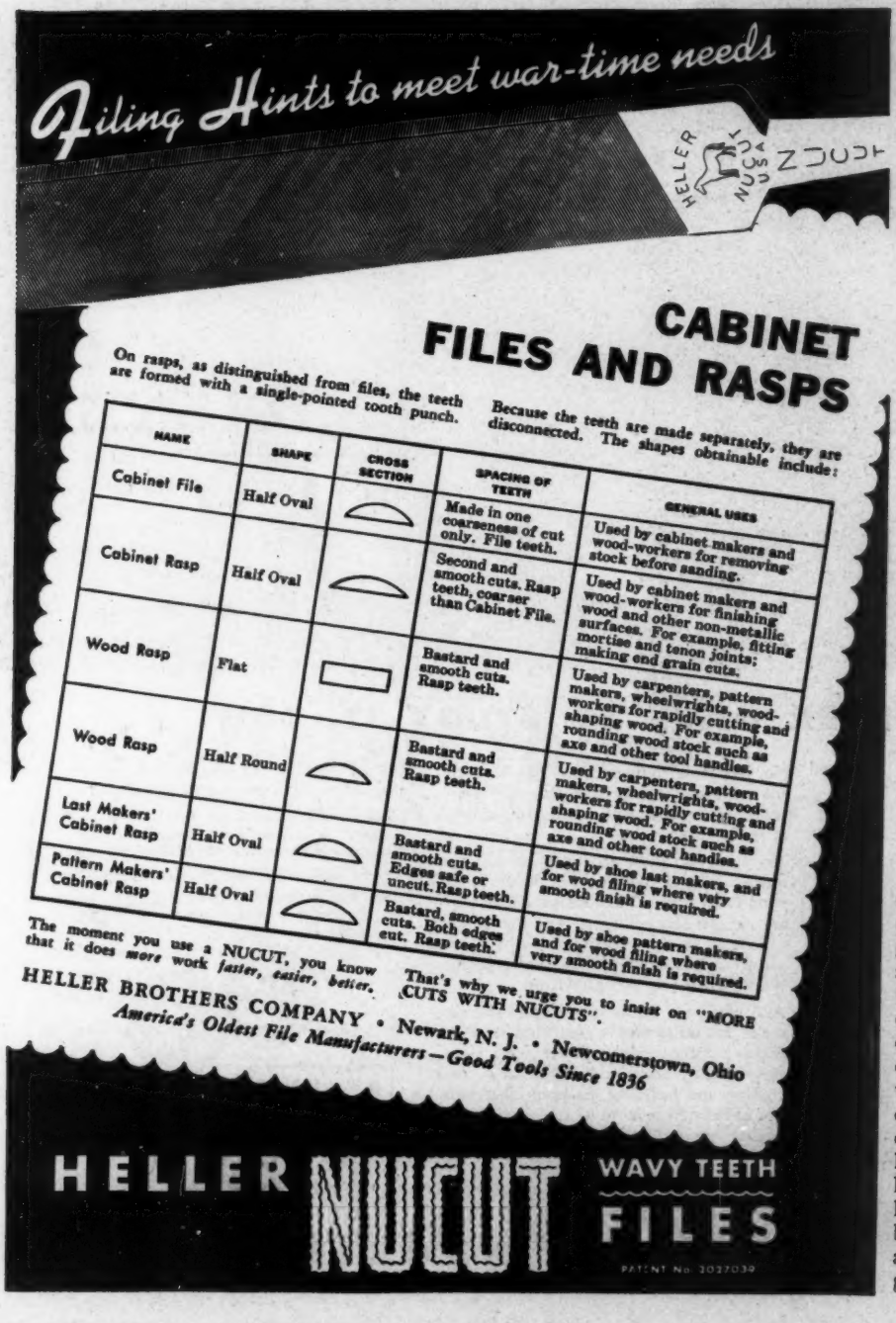
It will be noted that *attitudes* toward safety and accident prevention should be stressed more than other contributory factors and one may wonder if we are doing this consciously or using up our time in *mechanical don'ts*. Unless a *personal feeling* of responsibilty is engendered and developed we will have accidents, both trivial and serious. "Don't remove the jointer guard," is a command, which may or may not be heeded, but if the reason for this admonition is stressed, if the possible consequences are appreciated (through pictures or developing the imagination or even an anatomical discussion), in other words if we make the student *afraid of the possible results*, then one may expect a fairly good safety attitude — toward that particular device. Transfers of this type of reaction are not automatic and so similar discussions for other devices and tools, materials and situations are required if we expect to get first-class results. Of course, with a congenital fool killer, little can be done but hope.

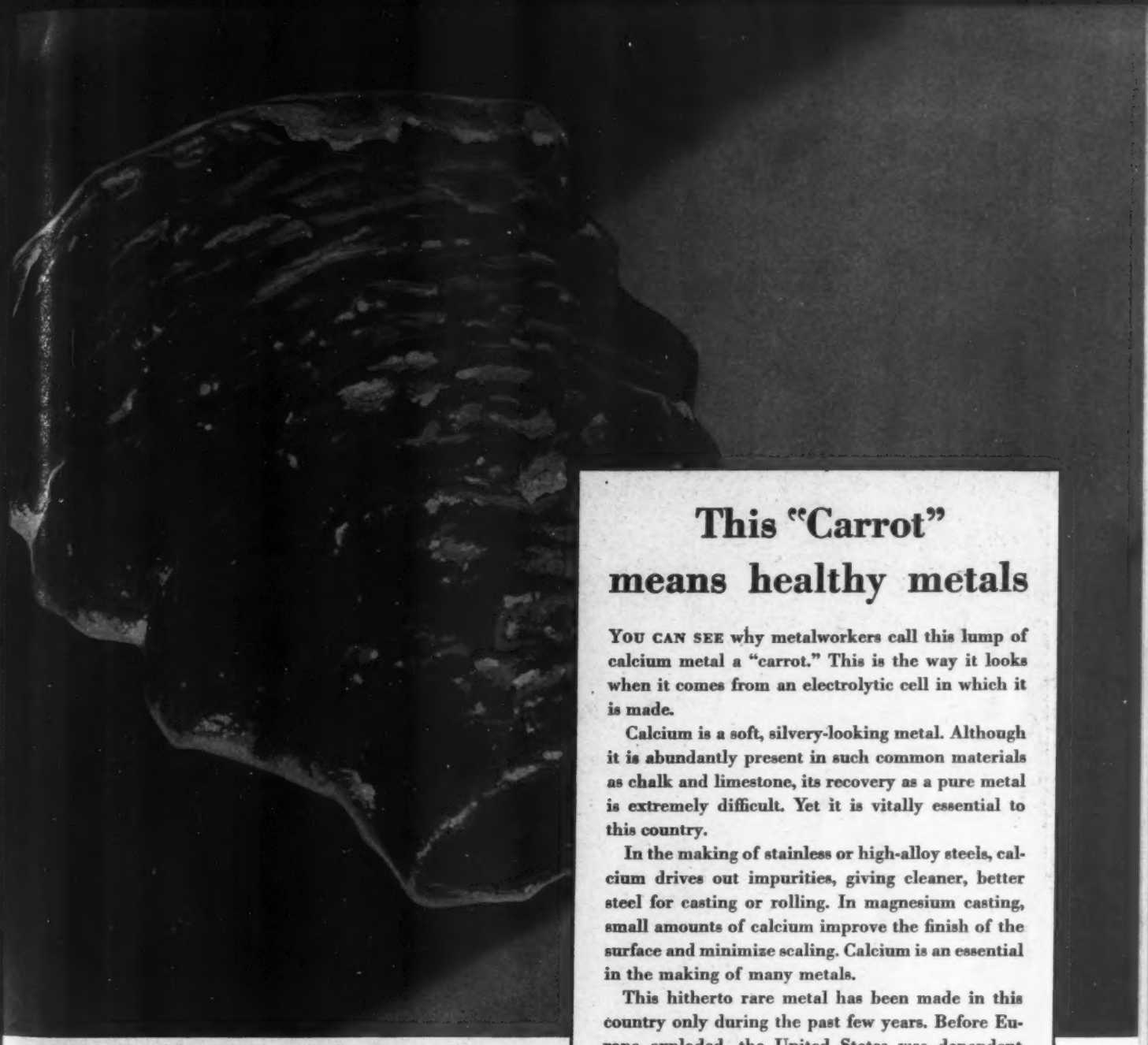
The writer had the safety attitude instilled into his being early in his life and forty years of almost daily contact with tools and machinery has left him unscathed — he is afraid of them as he recognizes their potential dangers nor has that fear made him a poor and slow operative, he is simply *careful* because . . . but why reiterate.

In closing, one may touch upon one feature of shop installation which has not received the attention it deserves, lighting, both natural and artificial — both are factors contributing to safety. Natural lighting should be ample and anywhere from 16 to 25 per cent of the floor area should be in terms of glass. The distribution of machines and equipment should be such to take advantage of day lighting and give good lighting on all work surfaces (15–20 f.c.) and minimize shadows on the work. This nearly always requires careful preliminary studies and planning which definitely involves the architect in case of new construction. Usually the latter needs education along this line.

In these times of long work hours and days the artificial lighting becomes a safety problem and a lot of attention should be given to it. General shop illumination should probably not be less than 10–12 f.c., though higher values are desirable. As indirect illumination is usually not possible due to building construction and expense of operation, a semidirect type of lighting with a ratio of, let us say, 30–60, is a good one if the ceiling may be used as a partial deflector — otherwise a direct type may have to be used, though this is likely to lead to undesirable heavy shadows. Local lighting on certain areas or machines can be provided depending upon the situation and the light requirements. Glare should be guarded against as this leads to eye fatigue

(Continued on page 25A)


Filing Hints to meet war-time needs
HELLER NUCUT
CABINET FILES AND RASPS
On rasps, as distinguished from files, the teeth are formed with a single-pointed tooth punch. Because the teeth are made separately, they are disconnected. The shapes obtainable include:
NAME | SHAPE | CROSS SECTION | SPACING OF TEETH | GENERAL USES
Cabinet File | Half Oval | | Made in one coarseness of cut only. File teeth. | Used by cabinet makers and wood-workers for removing stock before sanding.
Cabinet Rasp | Half Oval | | Second and smooth cuts. Rasp teeth, coarser than Cabinet File. | Used by cabinet makers and wood-workers for finishing wood and other non-metallic surfaces. For example, fitting mortise and tenon joints; making end grain cuts.
Wood Rasp | Flat | | Bastard and smooth cuts. Rasp teeth. | Used by carpenters, pattern makers, wheelwrights, wood-workers for rapidly cutting and shaping wood. For example, rounding wood stock such as axe and other tool handles.
Wood Rasp | Half Round | | Bastard and smooth cuts. Rasp teeth. | Used by carpenters, pattern makers, wheelwrights, wood-workers for rapidly cutting and shaping wood. For example, rounding wood stock such as axe and other tool handles.
Last Makers' Cabinet Rasp | Half Oval | | Bastard and smooth cuts. Edges safe or uncut. Rasp teeth. | Used by shoe last makers, and for wood filing where very smooth finish is required.
Pattern Makers' Cabinet Rasp | Half Oval | | Bastard, smooth cuts. Both edges cut. Rasp teeth. | Used by shoe pattern makers, and for wood filing where very smooth finish is required.
The moment you use a NUCUT, you know that it does more work faster, easier, better. That's why we urge you to insist on "MORE CUTS WITH NUCUTS".
HELLER BROTHERS COMPANY • Newark, N. J. • Newcomerstown, Ohio
America's Oldest File Manufacturers — Good Tools Since 1836
HELLER NUCUT WAVY TEETH FILES
PATENT No. 2027039



This "Carrot" means healthy metals

YOU CAN SEE why metalworkers call this lump of calcium metal a "carrot." This is the way it looks when it comes from an electrolytic cell in which it is made.

Calcium is a soft, silvery-looking metal. Although it is abundantly present in such common materials as chalk and limestone, its recovery as a pure metal is extremely difficult. Yet it is vitally essential to this country.

In the making of stainless or high-alloy steels, calcium drives out impurities, giving cleaner, better steel for casting or rolling. In magnesium casting, small amounts of calcium improve the finish of the surface and minimize scaling. Calcium is an essential in the making of many metals.

This hitherto rare metal has been made in this country only during the past few years. Before Europe exploded, the United States was dependent upon France as a source of supply.

But back as far as 1935, thinking that this country should have a domestic source, ELECTRO METALLURGICAL COMPANY, a unit of UCC, started a major research program. After four years of work . . . as French supplies dwindled . . . a plant was put into operation for the manufacture of the gray metal. Today, ELECTRO METALLURGICAL COMPANY produces many times as much calcium metal as this country ever imported . . . and production is increasing.

IN THE AIR SOONER! Vital aircraft parts flow from production lines quicker because the use of calcium metal results in better metal.

BETTER HEALTH! Pure calcium metal is used as a drying and purifying agent in the manufacture of certain new disease-fighting drugs.

CHEMICAL HELPER! Calcium is necessary in making a number of rare metals—many of which heretofore were unavailable commercially—and all of which are vital.

METAL-SAVER! In the melting of copper scrap for use in certain types of electrical equipment, calcium is used as a purifier and a restorer of electrical conductivity.

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

UCC

30 East 42nd Street — New York, N. Y.

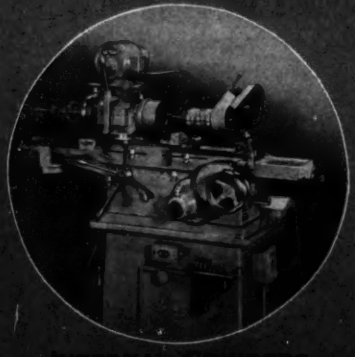
Principal Products

ALLOYS AND METALS
ELECTRODES, CARBONS AND BATTERIES
INDUSTRIAL GASES AND CARBIDE
CHEMICALS — PLASTICS

TOOL-ROOM LATHES

PLAIN BENCH LATHES

HAND SCREW MACHINES



INTERNAL GRINDERS

A JOB WELL TAUGHT IS LONG REMEMBERED

Many a fine toolmaker and master mechanic remembers the exacting problems given by his instructor and proudly recalls how he mastered the seemingly impossible tolerances with the aid of a Rivett lathe or grinder. Likewise many a scientist and engineer justly acknowledges the part played by a Rivett machine in his research and new developments. Today these very men rely on Rivett lathes and grinders when the closest precision limits must be maintained. In turn Rivett is proud of the part it has played in training master craftsmen and developing new products.

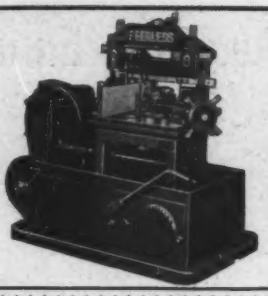
The first Rivett machine tools were made in 1884, and through the intervening years the builders have sought to perfect their every feature in pace with the progress of the times. Designing has been guided by wide and constant study of the usage in the field, and engineering has availed itself of new production methods and materials. Quality of workmanship has been protected by a group of skilled machinists and assemblers having life-long practice in the making and assembling of Rivett machines.

A proper and sound foundation of a machinist's training should include a knowledge of precision tolerances which can so well be taught on a Rivett machine.

Write for General Bulletin 500

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT

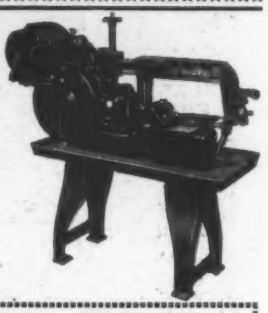
THE MORE THEY LEARN, THE MORE THEY WILL EARN



TRAIN THEM ON PEERLESS POWER METAL SAWS . . . . .

● Students gain more confidence in their ability to step right into a productive job when they are trained on the tools war industries use. Directors of vocational training know it reflects credit on the school, too, when the student is trained on machines found in everyday use in plants applying the most modern production methods.

Peerless Metal Cutting Saws are standard equipment wherever safe, accurate, fast, thrifty metal cutting is required. They have unique safety features which guard the student, the metal and the saw itself. They are automatic from the beginning to the end of the cutting cycle. Address Dept. J for literature giving other features of the Peerless Saw.



PEERLESS MACHINE COMPANY
RACINE, WISCONSIN

Peerless METAL SAWING MACHINES

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

PEERLESS MACHINE COMPANY, Racine, Wisconsin (Dept. J)
Please mail ( ) Catalog of Peerless Standard Power Saws
( ) Catalog of complete Peerless line: Hydraulic, Vertical and Universal Metal Sawing Machines

Name.....
School or Company.....
Address.....
City and State.....

SCHOOL-SHOP SAFETY

(Continued from page 22A)

and consequent seeing and incident hazards.

Virtually all of the features discussed are quite the obvious ones; the alert shop instructor will probably find others which need attention from the safety angle. Possibly these discussions may lead to an appreciation of the importance of the subject.

The slogan of the Future Craftsmen of America, "Service through craftsmanship," has added value for shop students in these times.

Personal News

♦ P. W. Chamness is now in his first year as director of vocational education and industrial arts in the Topeka, Kans., city schools. The program of vocational education is three semesters old in Topeka, and already Topeka High School has five vocational classes, including two distributive courses in office practices and retail selling, in addition to the regular industrial-arts work.

During the first year of the vocational education program in Topeka Mr. Chamness was part-time director, and he was made full-time director last summer. He received his B.S. from Kansas State Teachers College at Pittsburg, and his M.S. from Colorado State College at Fort Collins, Colo. Mr. Chamness has been a member of the Topeka city school faculty since 1929, and before that taught in the Pittsburg, Kans., city schools.

VETERAN TRADE TEACHER DIES

Mourned by faculty and students alike, Frederick H. Schoenig, head of the machine-shop department of the Boys' Trade and Technical High School, Milwaukee, Wis., for 34 years, passed from this earth on December 28, 1942, at the age of 67.

Frederick H. Schoenig

Mr. Schoenig was born in Neustadt, Germany, and came to America at the age of nine. He resided in Horicon, Wis., and served his apprenticeship as machinist in that city. Later he moved to Milwaukee, where he worked for the Edward P. Allis Works, which later became the Allis Chalmers Manufacturing Company. While working with this firm he was appointed foreman of the tool and die division.

At the founding of the Milwaukee School of Trades, later to become the Boys' Trade and Technical High School, Mr. Schoenig was one of the first instructors to be engaged.

Under his guidance, hundreds of boys became outstanding machinists and tool- and diemakers. His loss will be keenly felt by the many craftsmen who remember him as the kindly, though strict instructor, who initiated them in the intricacies of machine-shop work.

♦ Wayne P. Hughes, assistant professor of industrial-arts education at Eastern Illinois State Teachers College, Charleston, has been granted leave of absence to accept a special assignment in the field of vocational safety. He joined the staff of the Education Division, National Safety Council, 20 North Wacker Drive, Chicago, Ill., on January 2, as a consultant in industrial vocational safety.

♦ B. Alfred Cox, instructor of industrial arts and mathematics at Vashon High School, St. Louis, Mo., has been granted leave of absence to instruct machine-shop practice for the United States Naval Training Program, Hampton Institute, Hampton, Va. He has served as director of industrial education at Tennessee State College, possesses a M.S. degree in industrial education from Pennsylvania State College; a B.S. degree in mechanic arts from West Virginia State College; and a four-year machine-shop diploma from the Boston Trade School, Boston, Mass.

♦ Donald D. Williams, Franklin B. Kyker, Myron Rumbery, Vincent Vaugh, and Chris. E. Larson have been chosen to serve as instructors in the vocational classes recently started at Lincoln, Neb.

♦ L. H. Alberty was appointed director of vocational courses in trades and industries, and in farm machinery repair and construction at Lincoln, Neb.

(Continued on page 33A)

Metalworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSORS — for machine shop, foundry, or forge shop
ANVIL — 100 lb.
ARBOR PRESS — bench or pedestal type
BARROWS
- a) Coke
- b) Foundry
- c) Scrap

BELT LACER
BENCHES
- a) Coremaking
- b) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- c) Molding

BLACKBOARD — permanent or portable
BLOWERS — for furnaces, forges, etc.
BLOWTORCH — 1-qt. size
BOOKCASE — for reference books, catalogs, etc.
BORING BAR
BORING MILL — vertical or horizontal
BULLETIN BOARD
CABINETS — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
CASEHARDENING BOXES
CENTERING MACHINE
CHAIN HOISTS — differential, duplex or triplex
CHAIRS — teacher's, and tablet arm if needed for related-subjects room, or for demonstration section
CHUCK
- a) Drill, selected sizes
- b) Lathe, combination, 4 jaw, selected sizes
- c) Lathe, independent, 4 jaw, selected sizes
- d) Lathe, universal 3 jaw, selected sizes
- e) Milling machine, universal

CORE OVEN — for foundry
CRANES AND HOISTS — air, electric, or hand, of the jib, traveling, or portable type
CUPOLA — for foundry, coke, or electric, ¼- to 1-ton capacity
DESK — teacher's, with drawer compartments
DIE-FILING MACHINE
DIVIDING HEAD
DRILLS
- a) Bench, hand
- b) Breast
- c) Electric, portable
- d) Hand
- e) Post, hand or power
- f) Radial
- g) Sensitive
- h) Upright, power

FLASKS — 2 or 3 part, steel or snap type
FORGE — coal or gas, with hand- or electric-driven blower
FURNACES
- a) Annealing
- b) Bench
- c) Brass and soft metal
- d) Combination bench
- e) Casehardening
- f) Cyanide
- g) Gasoline
- h) Heat-treating
- j) Melting

GEAR-CUTTING MACHINE
GRINDER
- a) Bench, hand or power driven
- b) Combination grinder, buffer, and polisher
- c) Emery, bench or pedestal type
- d) Face, with magnetic chuck
- e) Portable tool post
- f) Precision, for external and internal grinding
- g) Universal tool cutter, drill and reamer grinder
- h) Wet tool

HACK SAW — motor or belt driven
HAND PICKS — for cleaning inside of cupola, 1¼ to 2½ lb.
HARDNESS TESTING MACHINE
LATHES — belt or individual drives
- a) Automatic
- b) Bench, 6-in. to 11-in. swing, 11 in. to 36 in. between centers
- c) Change gear, 9-in. to 14-in. swing, 18 in. to 36 in. between centers
- d) Quick-change gear, 9-in. to 16-in. swing, 18 in. to 36 in. between centers
- e) Semiquick-change gear, 9-in. to 18-in. swing, 18 in. to 42 in. between centers
- f) Turret
- g) Metal spinning

MILLING MACHINE
- a) Plain, cone or motor-driven type
- b) Universal, cone or motor-driven type

NIBBLING MACHINE
PIPE CUTTER
PLANER — belt or motor driven
POWER HAMMER — for forging operations
PUNCHES — metal, hand, or power
PYROMETER
PYROSCOPE
RELIEVING ATTACHMENT FOR LATHE
SAND SIFTER — for foundry, hand or power
SANDBLAST OUTFIT — with cabinet
SCALE
- a) Counter for machine shop
- b) Platform, for foundry, 1000-lb. capacity

SHAPER
SNAP-FLASK JACKETS — to fit snap flasks used
STRAIGHTENING PRESS
SURFACE PLATES
SWAGE BLOCK AND STAND — for forge shop
TAPER ATTACHMENT FOR LATHE
TRUCK — warehouse
TUMBLING BARREL — for foundry
VISES
- a) Blacksmith
- b) Drill press
- c) Machinist
- d) Pipe
- e) Planer
- f) Shaper

WELDING OUTFIT
- a) Acetylene
- b) Electric

Metalworking—Small Tools

ARBORS
- a) Drill chuck to suit requirements
- b) Reamers, various sizes
- c) Shell tool, various sizes
- d) Straight shank for shell reamers and shell drills, selected sizes
- e) Taper shank for shell reamers and shell drills, selected sizes

BEARING SCRAPER
BELLOWS — for foundry class
BEVEL PROTRACTOR
BROOMS AND FLOOR BRUSHES — for shop and foundry
BRUSHES
- a) Bench
- b) Core box
- c) Core painting
- d) Hard brushes for foundry
- e) Floor
- f) Soft brushes for foundry

BULB SPONGES — for molders
DRAW PINS — for molders
CALIPERS
- a) Hermaphrodite, 4 in. and 6 in.
- b) Inside, 4 in. and 6 in.
- c) Outside, 4 in. and 6 in.

CANS
- a) Oil, 1/3 pt., 1 pt., and 10 gal.
- b) Waste

CENTER TESTERS
CHISELS
- a) Cape, 3/8 in. and 5/8 in.
- b) Cold, 5/8 in. and ¾ in.
- c) Diamond point, 3/8 in. and ½ in.
- d) Roundnose, 3/8 in. and ½ in.

CLAMPS
- a) 4 in., 6 in., 8 in., and 10 in.
- b) Flask, for foundry
- c) Strap, various sizes

CAKE FORKS — for foundry
COLLETS
- a) For milling machine, selected sizes
- b) For lathe, selected sizes

COMBINATION SQUARES—with hardened head and blade, and protractor head, 9 in. and 12 in.
COUNTERBORES — straight and tapered shanks, selected sizes
COUNTERSINKS — for metal
CRUCIBLE TONGS — to fit crucibles
CRUCIBLES — selected sizes
- a) Shanks, single end to fit ladles
- b) Shanks, hand, to fit ladle bowls

CUTTERS — angular milling, bevel gear, concave milling, convex milling, end milling, face milling, formed milling, grooving, involute gear teeth, key seat, side milling, and metal slitting

DIVIDERS — Spring, 4 in. and 6 in.
DRILLS
- a) Drifts, different sizes
- b) Sleeves, different sizes
- c) Stand for Nos. 1 to 60
- d) Stand for 1/16 in. to ½ in. by 64ths

DRILLS
- a) Center
- b) High speed, taper shank, various sizes
- c) Jobbers, straight shank, 1/16 in. to ½ in. by 64ths
- d) Ratchet
- e) Straight shank, Nos. 1 to 60
- f) Taper shank, ½ in. to 1 in. by 16ths

FILE CARDS
FILES
- a) Die sinkers, various shapes
- b) Flat bastard, 8 in., 10 in., 12 in., and 14 in.
- c) Half round, double cut, 6 in., 8 in., 10 in., and 12 in.
- d) Hand, smooth, 8 in., 10 in., and 12 in.
- e) Mill, smooth, 8 in., 10 in., and 12 in.
- f) Round bastard, 8 in., and 10 in.
- g) Square bastard, 8 in., and 10 in.
- h) Swiss, various shapes
- j) Three-square, double cut, 6 in.
- k) Warding, double cut, 6 in.

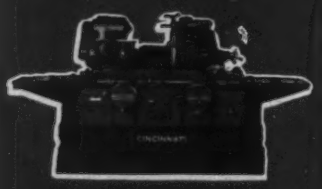
FIRST-AID CABINET AND SUPPLIES
FORGE TOOLS — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop
GATE STICKS — maple, for foundry
GAUGES
- a) Center
- b) Depth
- c) Drill and wire
- d) Screw pitch, select kinds
- e) Surface
- f) Thickness

GLOVES — asbestos, for foundry
GOGGLES
- a) For machine shop
- b) For foundry

HACK SAW
- a) Blades, hand, 18T, 10 in.

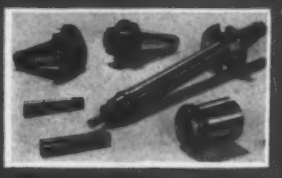
(Continued on page 28A)

WAR PRODUCTION WORKERS TRAINED ON CINCINNATI'S *Quickly Fill the Vacancies*



MANY of your students will unquestionably be called upon to operate or supervise the operation of CINCINNATI Milling Machines and Grinding Machines. Therefore, why not train them on the machines they eventually will have to use? CINCINNATI Milling and Grinding Machines are precision machine tools, sturdily built to stand the hard usage of student training. You will find them extremely versatile, safe to operate, easy to care for and throughly dependable.

We recommend for your consideration CINCINNATI No. 2 Universal MH Milling Machine; CINCINNATI 12"x36" Hydraulic Universal Grinder and CINCINNATI No. 2 Cutter and Tool Grinder. Catalogs giving full details on all features and their benefits will be sent on request. When writing for details, please say whether you are a teacher or school official.



CINCINNATI

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO, U.S.A.

WANT SOME TIPS ON TURNING TOOLS?

FREE!

WILLIAMS' TOOL DATA SHEETS

● If you are responsible for instruction in lathe operation, you can profit by the factual information contained in Williams' Data Sheet No. 7. Like others in this series, it is available, punched to fit a standard 3-ring binder or as 11"x14" wall posters. Subjects covered to date are listed below. Merely fill in and mail the coupon after circling or checking the numbers indicating the subjects you desire. Indicate also whether wanted for posters or for use in a binder.

1. Characteristics of Williams' "Superior" Wrenches.
2. Data on Williams' Boring Tools.
3. Data on "Vulcan" Chain Pipe Tongs.
4. Data on Williams' "Supersocket" Wrenches.
5. Data on "Vulcan" Lathe Dogs.
6. Data on "Vulcan" Chain Pipe Vises.
7. Data on Williams' Turning-Tools
8. Data on Williams' "Superior" Wrenches.
9. Saving Time with Williams' "Supersockets".
10. Data on "Vulcan" Eye Bolts.
11. Data on Williams' "C" Clamps.

MAIL THIS COUPON

J. H. Williams & Co., Dept. I-343, Buffalo, N. Y.

Please send Data Sheets circled below ☐ for binders ☐ for posters

1 2 3 4 5 6 7 8 9 10 11

*Name*_____

*Address*_____

*City*_____ *State*_____

WILLIAMS
SUPERIOR DROP-FORGED TOOLS

(Continued from page 26A)

b) Blades, power, 14T, 12 in.
c) Frames, adjustable

HAMMERS
a) Babbitt
b) Ball peen, 13 oz., 16 oz., or 20 oz.
c) Blacksmith's, various kinds
d) Riveting, 9 oz., and 12 oz.
e) Setting

INDICATOR
a) Center
b) Universal or universal dial test
c) Speed

KNURLING TOOL — with assorted knurls

LADLES
a) Bull
b) Hand bowls
c) Melting

LATHE DOGS — ⅜ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

LEGGINGS — fireproofed duck, to protect students when pouring in foundry

LEVEL — 6-in. bench

LIFTING SCREWS — for molders

MALLETS — wood or soft

MANDRELS — selected sizes

MICROMETERS — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.

MOLDING BOARDS

MOLDING STICKS AND TROWELS — various kinds

NIPPERS — end cutting, 5 in.

OIL STORAGE TANK — with pump

OILSTONES — medium and fine

PAILS — galvanized, 12-qt. capacity for foundry

PARALLELS
a) Adjustable
b) Steel, assorted sizes

PLIERS
a) Combination, 6 in.
b) Side-cutting, 6 in.

PUNCHES
a) Center, ¼ in. and ⅜ in.
b) Hollow, ½ in., ¾ in., and 1 in.
c) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
d) Prick, ¼ in.

RAMMERS — for foundry
a) Hand
b) Floor

REAMERS — various sizes
a) Adjustable
b) Hand
c) Taper pin
d) With taper shank

RIDDLES — ¼-in. and ⅜-in. mesh, 18-in. diameter, for foundry

RIVET SETS — assorted sizes

SCALES
a) Steel, 6 in., graduated 1/64 in. to ⅛ in.
b) Steel, 12 in., graduated to 32nds

SCREW DRIVERS — 6 in. and 9 in. blade

SCRIBERS

SHOVELS
a) Coke
b) Sand

SNIPS — tin, 3 in. straight and 3 in. curved

SOCKETS — for taper shanks, drill and tools, selected sizes

SOLDERING COPPERS AND HANDLES — 1-lb. size

SPRAY CAN — for molders

SPRINKLING CANS — galvanized iron, 16-qt. capacity, for foundry

SPRUE PICKS — for molders

SQUARES
a) Machinist's, 6 in.
b) Blacksmith's

STEEL FIGURES, ⅛ in.

STEEL LETTERS — ⅛ in.

SWABS — for molders

TAPELINE — steel, 25 ft.

TAPS AND DIES
a) Machine screws
b) Pipe
c) N.F. ¼ in. to ¾ in.
d) N.C. ¼ in. to ¾ in.

TONGS
a) Blacksmith's, various kinds
b) Pick up, for foundry
c) Shake out, for foundry

TOOL HOLDERS
a) Boring tools
b) Cutting-off tools
c) Planer
d) R.H. and L.H. offset shank
e) Shaper
f) Slotter
g) Straight shank
h) Threading

TOOL-HOLDER BITS — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.

TRAMMEL POINTS

V BLOCKS AND CLAMPS

WHEEL DRESSER

WRENCHES
a) Adjustable, 8 in. and 10 in.
b) Pipe, 8 in. and 12 in.
c) Tap, adjustable, various sizes

Metalworking— Materials and Supplies

ABRASIVE CLOTH — aluminum oxide. Grits 320 to 24, obtainable in sheets or rolls from 1 to 28 in. wide

ABRASIVE WHEELS

ACETYLENE GAS — in drums for welding

ALUMINUM
a) Pigs for foundry
b) Sheets, tubing, rounds, shapes, wire, etc.

BABBITT METAL

BEARING BLUE

BELT DRESSING

BELT LACING MATERIAL

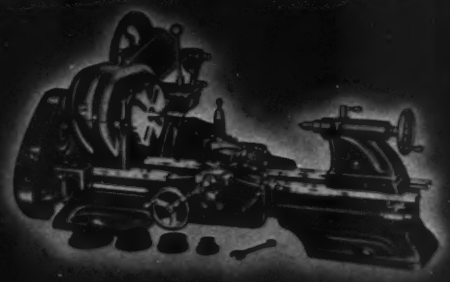
BELT LEATHER

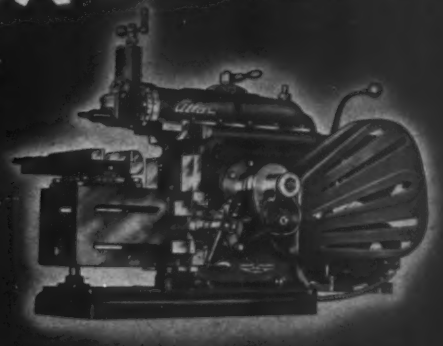
BOLTS
a) Carriage, selected sizes
b) Lag, selected sizes
c) Machine, selected sizes
d) N.F., selected sizes
e) Stove, flat or roundheads, selected sizes

BRASS
a) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
b) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
c) Sheets, 28 to 32 American gauge, 12 in. wide by 72 in. to 84 in. long, selected sizes

(Continued on page 30A)

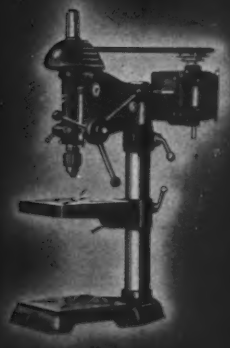
Atlas TOOLS FOR VICTORY





LATHES Atlas Lathes offer complete flexibility for speed and ease of operation in the fundamentals of training a modern background. Extra-strong rugged. Yet their low cost helps you make substantial savings in equipment investment.

SHAPERS Atlas Vise-Type Shapers have all the ruggedness and power of larger, more expensive machines. Have 4 speeds and 4 automatic cross feeds. These shapers quickly give trainees the feel and precision experience necessary to assure on-the-job success.



MILLING MACHINES These versatile, precision bench millers give maximum flexibility to every milling operation, at low cost. Provide the full range of milling, from end milling and facing cuts to end milling, keyways, hobbing and linear work.

DRILL PRESSES Atlas Drill Presses offer speeds from 460 to 5,420 rpm, in seven steps. Ample power for high speed performance on small parts. Atlas Drill Presses assure you the modernism, reliability and low cost you want in drill press service. Four models available.

These four Atlas Tools play a significant part in the program for victory. Frequently they are in the thick of things, in the mobile machine shops of the armed forces. Their biggest job is on war production in thousands of plants fashioning America's unbeatable weapons and in vocational schools training workers to keep production rolling.

If you have a War Production Training program we urge you to investigate the time and money savings possibilities of equipping with Atlas basic tools. Minutes and hours are precious now. If you are not in War Production Training, help all by making your present tools serve for the duration. Atlas Press Company 371 North Pitcher Street, Kalamazoo, Michigan.

It's wise now not to wait for your normal equipment buying time to place orders. Ordering now may save much delay.

ARMY E NAVY

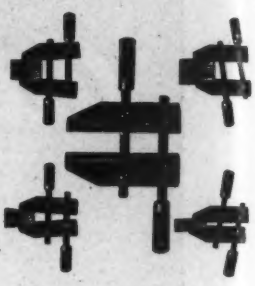
HARGRAVE CHISELS - PUNCHES - CLAMPS

for EVERY SCHOOL SHOP NEED

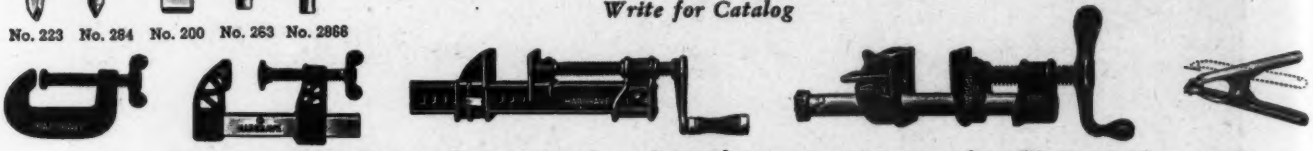
No. 223 No. 284 No. 200 No. 263 No. 2868

Hargrave chisels, punches and clamps are built to stand up, day after day, to the toughest assignments handed out in school or factory. Experienced workmen prefer them for their superior construction, workmanship and economy.

Hargrave tools are individually tested for strength and freedom from flaws. This added protection assures longer life and outstanding service—costs no more. Hargrave chisels, punches and clamps are made in a wide range of styles and sizes.



Write for Catalog



The name Hargrave on clamps, chisels and punches represents more than 60 years of experience, continuously devoted to the production of better hand tools for mechanics. Your jobber can supply you.

THE CINCINNATI TOOL COMPANY

WAVERLY and MAIN AVES. CINCINNATI, OHIO

(Continued from page 28A)

- *d*) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
- *e*) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
- *f*) Wire, soft, 8, 11, and 14 American gauge, selected sizes
- *g*) Wire, spring, 8 to 22 American gauge, selected sizes

CASEHARDENING COMPOUNDS

CHAPLETS — single and double head

COAL
- *a*) Charcoal for foundry or forge
- *b*) Coke for foundry
- *c*) Forge

COPPER
- *a*) Pigs, for casting alloys
- *b*) Sheets, 8 to 25 American gauge, 30 in. by 60 in., selected sizes
- *c*) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
- *d*) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼, ½, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

CORE
- *a*) Compounds
- *b*) Flour
- *c*) Paste
- *d*) Oil
- *e*) Wax-vent wire

CUTTING COMPOUNDS

FIREBRICKS AND CLAY — for foundry

FIRE HANDLES — assorted sizes

GRAPHITE — for foundry

IRON — Pig, for foundry

LACQUER — transparent and colored, for finishing

NUTS — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds

OIL
- *a*) Boiled linseed
- *b*) Lubricating
- *c*) Quenching and hardening

PACKING
Round, sheet, square, or tubular

PAINT — back asphaltum

PINS
- *a*) Cotter, 3/32-in. to ¼-in. diam. from ½ in. to 2 in. long
- *b*) Flask, for flask repairs
- *c*) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

PUMICE POWDER

RIVETS
- *a*) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
- *b*) Iron, No. 14 gauge to 3/16 in., flathead or button head, ¼ in. to 1 in. long, selected sizes
- *c*) Tinners', flathead, 8 oz. to 16 lb., either tinned or black, selected sizes

SAND
- *a*) Molding, in 350-lb. barrels or 800-lb. casks
- *b*) Parting, in 350-lb. barrels or 800-lb. casks

SCREWS
- *a*) Flathead or roundhead iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds
- *c*) Set, head and headless

SOLDER — acid or rosin core; bar, or solid wire

SOLDERING PASTE OR SALTS

STEEL
- *a*) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4-ft. lengths, selected sizes
- *b*) Bars, cold rolled, ⅛ in. to ⅜ in. thick, ⅛ in. to 2 in. wide, 12-ft. lengths, selected sizes
- *c*) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3-ft. lengths, selected sizes
- *d*) Rods, hexagon and square, cold rolled, ¼ in. to ¾ in., in 12-ft. lengths, selected sizes
- *e*) Round, cold rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
- *f*) Sheet, black, Nos. 18, 20, 22, 24, 26, 28, U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in.
- *g*) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U. S. gauge; size of sheets, 24 in., 28 in., and 30 by 96 in., selected sizes
- *h*) Threaded rods, Nos. 6 to 10, in 12-in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24-in. lengths, selected sizes

TIN
- *a*) Pigs, for casting alloys
- *b*) 1C, 1X, 20 by 48 in.
- *c*) 1XX, 20 by 48 in.

WASHERS AND BURRS
- *a*) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
- *b*) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
- *c*) Brass washers, 3/16 in. to ½ in. by 16ths
- *d*) Iron washers, 3/16 in. to ½ in. by 16ths

WELDING FLUXES

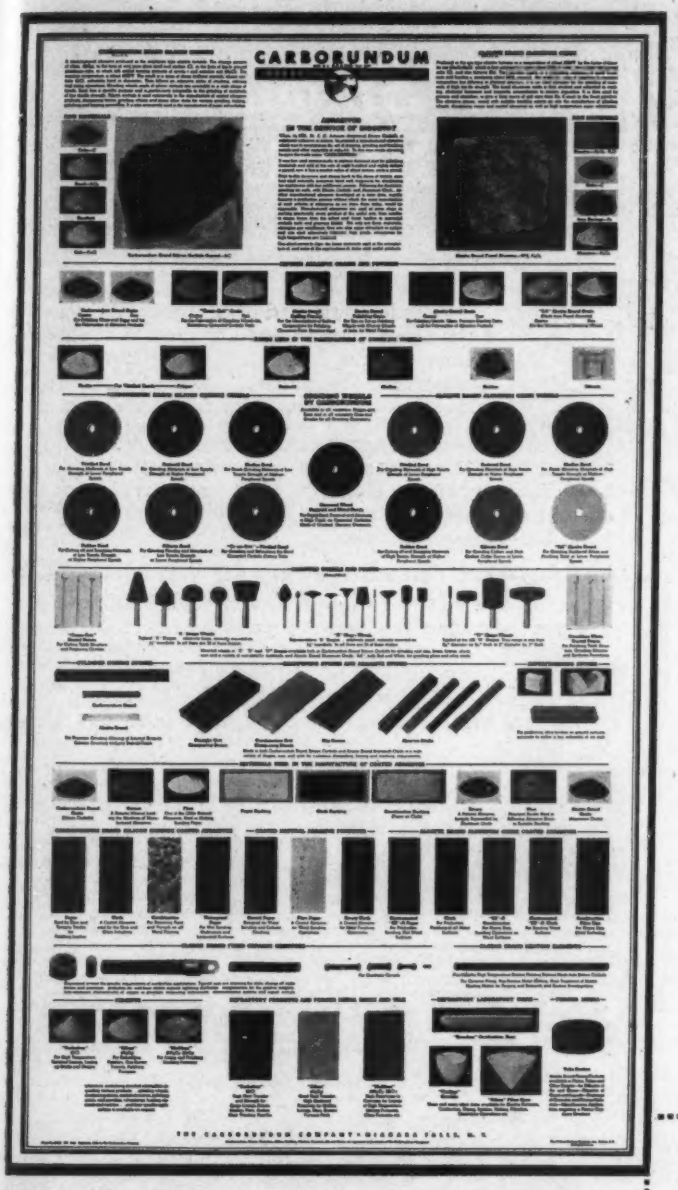
WELDING RODS (all rods come in 24-in. lengths)
- *a*) Brazing, 1/16-in., ⅛-in., and 3/16-in. diameter
- *b*) Cast aluminum, 3/16-in., ¼-in., and ⅜-in. diameter
- *c*) Cast brass, 3/16-in., and ⅜-in. diameter
- *d*) Cast bronze, ¼-in. diameter
- *e*) Cast copper, 3/16-in. and ¼-in. diameter
- *f*) Cast iron, 3/16-in., ¼-in., 5/16-in., and ⅜-in. diameter
- *g*) Low carbon steel, ⅛-in., ¾-in., and ¼-in. diameter

WHITE LEAD — for machine shop

WIRE
- *a*) Annealed, 16 to 34 W and M gauge, selected sizes
- *b*) Coppered market, 5 to 18 W and M gauge, selected sizes
- *c*) Coppered spring, 2 to 18 W and M gauge, selected sizes
- *d*) Galvanized, 5 to 18 W and M gauge, selected sizes
- *e*) Piano, Nos. 2/0 to 36, selected sizes
- *f*) Tinned, 16 to 24 W and M gauge, selected sizes
- *g*) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

ZINC
- *a*) Pigs, for casting alloys
- *b*) Sheet, Nos. 4 to 14, sheets 36 in. by 84 in.

TO MAKE YOUR WARTIME TEACHING EASIER!



Valuable wall chart in full color, 23" x 41" tells story of

MANUFACTURED ABRASIVES!

Free to instructors . . . Mail coupon NOW!

EVERY moment counts today . . . on the instruction front as well as on the production front. This chart will help your students to a quicker and better understanding of one of our basic industries . . . the manufacture of abrasive products, indispensable tools for *all* industry.

Printed in natural colors, it shows the principal steps in the manufacture of Carborundum Brand Silicon Carbide and Aloxite Brand Aluminum Oxide Abrasives as well as the Super Refractories and Heating Elements produced by The Carborundum Company.

Containing the nucleus of material for class lectures, this chart is free to instructors of industrial arts, vocational or science classes. Simply fill out and send us the coupon below. Be sure to give your name and address, your school and the courses you teach or your title.

THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.

Niagara Falls, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

[**Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company**]

THE CARBORUNDUM COMPANY
Niagara Falls, N. Y.

Please send me, free of charge, your natural-color educational wall chart for classroom use.

Name .....

Address .....

School .....

Courses taught (or title) .....

Detroit Public Library

IT'S SOUND JUDGMENT

TO *Teach Arc Welding*

with arc welders that enjoy such wide industrial acceptance as...

HOBART "Simplified" ARC WELDERS

HOBART
Electric Drive
Arc Welders
are available in a wide range of models, 100 to 800 amperes. Ask for Catalog.
Junior Electric
Junior Electric

Here's Why...

Your students trained on Hobart Welders have more than an even chance to adapt themselves to production conditions because the "Simplified" features of a Hobart let them spend more time on actual training.

Hobart's Exclusive Remote Control enables students to adjust welding heat right at the work when changing rods or position. Hobart's 1,000 combinations of current and voltage gives the EXACT heat for every job. Use coupon for details.

PRACTICAL "DESIGN FOR ARC WELDING"

Actual data sheets designed by a famous welding expert showing the various ways in which arc welding can be applied to machine and product design. Every welding school should have these. A request on your letterhead or by checking coupon below will bring them with our compliments.

NEW up-to-the-minute **BOOKS** on Arc Welding Uses, Techniques, Materials, Etc.

Prepares Students for Big Pay Jobs

Teach your students one of the world's best paying trades.

Send Coupon!

Ask for school quantity prices.

Just off the Press **"PRACTICAL ARC WELDING MANUAL and Training Course"**

This entirely new 1942 welding manual belongs on the desk of every student, engineer, designer and welding operator interested in any branch of the metal working industries. The entire book is written in plain English and contains 516 pages supplemented by hundreds of illustrations, tables and charts for easy understanding. Postpaid, only..... **$2**

Valuable LESSONS BOOK

This same 192 page "Lessons in Practical Arc Welding" book is used in the well-known Hobart Trade School to teach students the essentials and finer points of arc welding methods and applications. It tells everything one needs to know in operating a modern arc welder and gives exercises in practical welding problems. Liberally illustrated with photographs and self-explanatory drawings and diagrams. Postpaid, only..... **75¢**

Special school prices in quantities

HOBART BROS., TROY, OHIO

"One of the World's Largest Builders of Arc Welders"

• **Hobart Brothers, Box IAV-33, Troy, Ohio**

GENTLEMEN: I'm interested in Hobart Arc Welders for our school. Please send details. Also send me book checked — check or money order enclosed.

☐ Practical Arc Welding Manual ☐ Hobart Lessons Book

☐ Practical Design for Arc Welding

NAME

POSITION SCHOOL

ADDRESS

PERSONAL NEWS

(Continued from page 25A)

♦ LLOYD DECKER, who taught at Mechanic Arts School, Evansville, Ind., is now in the armed forces.

♦ CHARLES EPPERSON, who taught industrial arts in Ft. Branch, Ind., has replaced Norman Lewellyn at Washington School, Evansville, Ind.

♦ RAY ANGERER is serving with the Air Corps. His position at Delphi, Ind., has been filled by R. G. Bradshaw, formerly of Rockfield, Ind.

♦ WILBUR STONER, who formerly taught at Dunkirk, has accepted a position of industrial-arts instructor in the junior high school at New Castle, Ind.

♦ ALFRED O. BAKER is teaching general shop classes in the High School, New Castle, Ind.

♦ LESTER VICKERS, formerly of Oxford, Ind., is the new drafting teacher in the New Castle school system.

♦ DENNIS PRICE, vice-president, Indiana Industrial Education Association, has been elected to the national chairmanship of Iota Lambda Sigma.

♦ HENRY BECKNER, former industrial-arts teacher at Walton High School, Walton, Ind., is now in the Navy.

♦ RUSSEL WALTERS, formerly industrial-arts teacher at Richland Center High School, Rochester, Ind., is now in the army.

♦ NORMAN LEWELLYN has been transferred from Washington Elementary School, Evansville, Ind., to Reitz High School to replace Wilbur Harrell. Mr. Lewellyn has changed the auto shop into a general metal shop.

♦ LIEUTENANT O. A. OAKS, U. S. Coast Guard, has been granted leave of absence for the duration by the New Trier Township High School, Winnetka, Ill.

He has been assigned to active service.

♦ MAX HANNUM, Baker Elementary School, Evansville, Ind., has taken a position with the Briggs Corporation.

♦ H. G. BUGG, former machine-shop teacher at Kokomo, Ind., is now in industry.

♦ CHESTER TOMPSON has been appointed machine-shop instructor at Kokomo, Ind.

♦ WILBUR HARRELL, Reitz High School, Evansville, Ind., has taken a position with Hoosier Lamp and Stamping Co., Evansville, Ind., as educational director.

♦ JOHN RACE, Stanley Hall Elementary School, Evansville, Ind., has taken a position with the Republic Aircraft Company.

♦ CLARENCE EVER is teaching farm shop work in Delphi, Ind.

Association News

A.V.A. CONVENTION

(Continued from page 23A of the February, 1943, issue)

The industrial-arts sectional meetings were all well attended. The first one was held on Thursday morning, December 3, 1942. Dr. Lawrence F. Ashley, chief, division of vocational education, Yonkers, N. Y., was chairman of this meeting, for which the theme, "Success Factors in the Growth and Achievement of the Teacher of Industrial Arts," had been chosen.

Fred J. Schmidt, Jr., associate professor of industrial arts, Ball State Teachers College, Muncie, Ind., speaking on the subject, "Some Factors in the Growth and Achievement of the Teacher of Industrial Arts," emphasized the great need of better teaching, enrichment of program, good housekeeping, pupil participation in class management, and making the work available to girls as well as to the boys, as factors of achievements which we ought to try to achieve under present conditions.

Charles Herlihy, president, State Teachers College, Fitchburg, Mass., spoke on "Professional Preparation As a Factor in the Growth and Achievement of Teachers of Industrial Arts." He emphasized the need of the experimental workshop in the teacher training college, and also stated that industrial arts must help in the reorganization of secondary education.

He advocated the clarifying of objectives, limiting them as to number, but making them specific. He deplored the fact that so many industrial-arts teachers are being inducted especially since their subject is so vital in preinduction training which must, as a matter of necessity, be emphasized during the present crisis in all industrial-arts classes.

Harold Silvius, assistant professor of industrial education, College of Education, Wayne University, Detroit, Mich., summarized the session.

T. A. Hippaka, professor of industrial education, Iowa State College, Ames, Iowa, was the chairman of the afternoon session at which the "Problems and Procedures of Industrial Arts in the Small School," were discussed.

Clyde Bowman, dean, Stout Institute, Menomonie, Wis., spoke on "The Preparation of Industrial-Arts Teachers for the Small School." The speaker emphasized that the industrial-arts teacher must thoroughly understand the basic operations in all phases of industrial activity. The preparation

(Continued on next page)

ARMSTRONG
TOOL HOLDERS . . . TOOLS
ARMSTRONG
Drop Forged
"C" Clamps
Stiffer, stronger clamps —Heavy Duty, Medium Service, Deep Throat, Light Service and Tool Makers types. All sizes.
ARMSTRONG
Tool Holders
for every operation on Lathes, Planers, Slotters and Shapers that "Saves: All Forging, 70% Grinding and 90% High Speed Steel."
ARMSTRONG
Setting-Up Tools
A complete line of T-Slot Bolts, Planer Jacks and drop forged Strap Clamps.
ARMSTRONG
Turret Lathe and Screw Machine Tools
Drill Holders, Plain Turners, Straight and Angle Cutter Holders, Multiple Cutter Holders, Facing and Knurling Tools.
ARMSTRONG
Drop Forged Wrenches
Over 100 types of Drop Forged Carbon and Chrome-Vanadium Wrenches. Each in all sizes.
ARMSTRONG
Drop Forged Lathe and Milling Machine Dogs
11 types, in all sizes with alloy screws hardened at point.
ARMSTRONG
High Speed Bits and Blades
Finest Cutting Steel, heat treated and hardened. Also, ready-ground in standard cutter forms both "High Speed" and "Carbide-Tipped."
"ARMSTRONG BROS."
Better Pipe Tools
The most complete line manufactured. Each an improved tool built to industrial standards.
ARMSTRONG
Chrome-Vanadium Socket Wrenches
All sizes and types with drop forged ratchets.
Teach with the tools actually used by industry.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

322 N. Francisco Ave., Chicago, U. S. A.

Eastern Warehouse and Sales Office: 199 Lafayette St., N.Y.

(Continued from previous page)

of such teachers takes time, but in this emergency it must be done in about half the time previously required. Roy Van Duzee, director, School of Vocational and Adult Education, West Allis, Wis., spoke on "The Industrial-Arts Offerings in the Small High School." Mr. Van Duzee pointed out that present-day needs make industrial arts a necessity in every high school. Industrial arts is good in times of peace but especially in times of war. If properly taught it develops the ability to appraise a problem, project a plan for its solution, and follow that plan with resourcefulness — all characteristics necessary to the democratic way of life.

At the Friday afternoon session at which "Industrial Arts in the Postwar Era" was discussed, Homer J. Smith, professor of industrial education, University of Minnesota, Minneapolis, Minn., occupied the chair.

Verne L. Pickens, supervisor of practical-arts education, Kansas City, Mo., presenting the supervisor's viewpoint of the theme subject, emphasized the need for giving basic training and work experiences to students in the industrial-arts workshops, not forgetting that good guidance must accompany this work, and that good craft standards and leisure-time activities must not be forgotten.

Dean Schweickhard, assistant superintendent of schools in charge of industrial-arts education, Minneapolis, Minn., presenting the viewpoint of the general administrator, said that industrial arts has the wherewithal to activate other studies and give the students incentives for doing things. Industrial arts, he pointed out, has its own appeals, and needs no artificial incentives.

The present demands sacrificing, but this must be done to make ultimate victory possible. The future demands that industrial arts avoids mere tinkering and that it become active in many scientific and technical areas for which the thorough cooperation of industry must be secured.

At the Saturday morning meeting William T. Bawden, head, department of industrial education, Kansas State Teachers College, Pittsburg, Kans., was the chairman. The theme for this meeting was "Significant Trends and Relationships of Industrial Arts." George F. Weber, director of industrial education, and director of vocational training for war-production workers, South Bend, Ind., who spoke on "Trends in Junior and Senior High School Industrial Arts," pointed out that the present emergency makes it necessary to train girls as well as the boys in the school shops. The emphasis on the products, processes, materials, and problems of industry must be intensified in our concept of industrial arts during this emergency.

"Trends in the Preparation of Teachers of Industrial Arts" was the subject upon which Albert F. Siepert, dean of education, Bradley Polytechnic Institute, Peoria, Ill., spoke, and Frank Moore, director, industrial arts, Cleveland, Ohio, remarked that industrial arts is looked upon as vocational education just now. He cautioned that we must be careful of how this idea is embodied in our work lest every boy will have a war of his own after the emergency.

Vice-president Arthur B. Mays, professor of industrial education, University of Illinois, Urbana, Ill., made his annual report. His advice to the industrial-arts members follows: When you register, do so as a teacher of industrial arts, not of industrial education; foster good feeling between industrial arts and vocational education; help local, state, and national research committees whenever possible; and do not get the idea that industrial arts would advance if it had federal aid.

At the ship program, which was held Friday at 9 p.m., John Claude, of The Bruce Publishing Company, Milwaukee, Wis., was in charge as deck officer.

When Time is Short and Labor is Scarce

You Can Do More With a Dumore

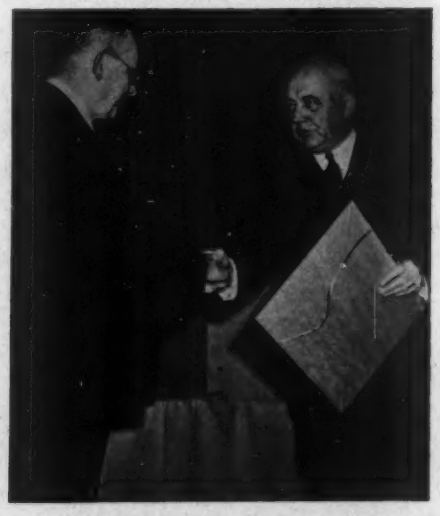
How quickly and how well your pupils are trained for war jobs depends largely on the tools they use. Dumore Hand Grinders are important tools of industry today. They do hundreds of everyday jobs in tool rooms and on production lines quickly and accurately. Dumore Hand Grinders are precision built; every rotating part is dynamically balanced to eliminate vibration, reduce operator fatigue, provide finger-tip balance and control. Available in seven types and sizes, with speed and power to handle any off-hand grinding job. Write for our helpful instruction book: "The Care and Operation of Portable Precision Grinders."

THE DUMORE CO., Dept. 233-C, RACINE, WISCONSIN

DUMORE No. 9
Big and powerful, yet easy to handle. Weighs 7½ lbs., has ¼ h.p. motor, idles at 15,500 r.p.m. Forced ventilation, convenient trigger switch in end handle.

DUMORE No. 10
Most popular model, widely used in production. Has 1/10 h.p. motor, idles at 22,000 r.p.m., weights 47 ozs. Maximum power with minimum weight.

Dumore
PRECISION GRINDERS



Charles W. Sylvester receives the distinguished service award

The song leader was M. M. Hamlin, American Type Founders Sales Corporation, Elizabeth, N. J.

The annual distinguished Service Award this year was presented to Charles W. Sylvester, director of vocational education, Baltimore, Md., who has been the treasurer of the A.V.A. for the past 13 years.

(Continued on page 36A)

THE MOST *Important* TOOL ON THE BENCH IS A **VISE** BE SURE IT IS A

COLUMBIAN

COLUMBIAN MACHINISTS' VISES

REPLACEABLE TOOL STEEL JAW FACES
STEEL BALL ENDS FORGED FROM HANDLE STOCK ITSELF
COLD ROLLED STEEL SCREW
SELF-LUBRICATING THRUST BEARING
POSITIVE LOCKING SWIVEL BENCH PLATE
SLEDGE TESTED
MALLEABLE IRON CASTINGS GUARANTEED UNBREAKABLE

• **STATIONARY BASE VISES** are machined flat and can be mounted without cutting the bench.

Stationary Base Machinists' Vises

Vise No.	Width Jaws	Jaws Open	Weight Pounds
503	3	4½	20
503½	3½	5½	29
504	4	6	36
504½	4½	7	47
505	5	8	58
506	6	10	90

• **COLUMBIAN MACHINISTS' VISES** are designed to provide accurate and dependable equipment for school and industrial shops.

T SECTION JAW FACES of hardened tool steel are pinned into the castings so they cannot come loose in use, but may be replaced if chipped or worn.

MALLEABLE IRON CASTINGS, an exclusive Columbian Machinists' Vise feature, provide increased working strength and are absolutely guaranteed unbreakable.

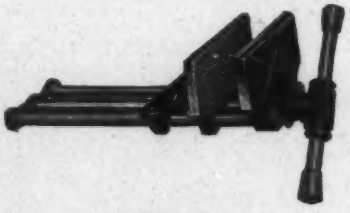
STEEL SCREW and **MALLEABLE IRON NUT** are designed for heavy duty. Hardened steel washer under the screw head prevents wear on front jaw casting.

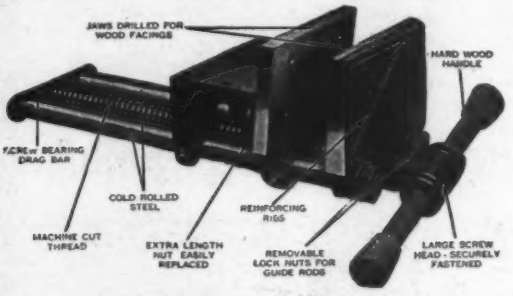
• **SWIVEL BASE VISES** are positively locked by a forged steel lock bolt, designed with teeth which are drawn into gear-like corrugations in the base plate.

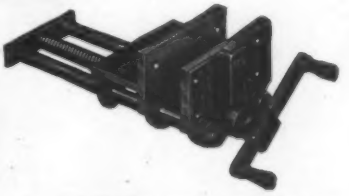
Swivel Base Machinists' Vises

Vise No.	Width Jaws	Jaws Open	Weight Pounds
603	3	4½	25
603½	3½	5½	34
604	4	6	42
604½	4½	7	55
605	5	8	70
606	6	10	106

COLUMBIAN WOODWORKERS' VISES




JAWS DRILLED FOR WOOD FACINGS
HARD WOOD HANDLE
SCREW BEARING DRAG BAR
COLD ROLLED STEEL
REINFORCING RIBS
MACHINE CUT THREAD
EXTRA LENGTH NUT EASILY REPLACED
REMOVABLE LOCK NUTS FOR GUIDE RODS
LARGE SCREW HEAD - SECURELY FASTENED



Rapid Acting Woodworkers' Vises

• Simple rapid acting mechanism consists a bronze half-nut operating in the groove p duced by milling off a section of each thre for the length of the screw. A slight turn the handle engages the threads of the nut a screw, and a half turn tightens the vise the work.

MADE IN ALL POPULAR SIZES

Rapid Acting Woodworkers' Vises	Plain Front Jaw		Dog in Front Ja	
Vise No.	1R	9R	1RD	9
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	24	32	25	33

Continuous Screw Woodworkers' Vises

• Extra heavy steel screw with carefully cut double threads operates in a solid malleable iron self-centering nut and insures positive fast action. Cold rolled steel guide rods, with drag bar as screw bearing, insure alignment and accuracy.

Continuous Screw Wood Handle Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	5C	3C	5CD	3CD
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	22	30	23	31

• **ADJUSTABLE STEEL HANDLE** increases speed of operation. With the handle centered at the screw head, the shortened radius permits quick adjustment of opening. By extending the handle, extra leverage is obtained to tighten the vise.

Continuous Screw Steel Handle Vises	Plain Front Jaw		Dog in Front Jaw	
Vise No.	5C-S	3C-S	5CD-S	3CD-S
Jaw Size, in.	4x7	4x10	4x7	4x10
Jaws Open, in.	9	12	9	12
Weight, lbs.	24	32	25	33

The Columbian Line also includes Combination Pipe Vises, Hinged Pipe Vises, Homeshop Vises, Blacksmiths' Leg Vises, Bench Anvils, and "C" Clamps

THE COLUMBIAN VISE & MFG. CO.

9017 Bessemer Avenue Cleveland, Ohio

WORLD'S LARGEST MAKERS OF VISES

(Continued from page 34A)

The presentation was made by Ralph S. Foss, McGraw-Hill Book Company, New York, N. Y.; and John A. Backus, American Type Founders Sales Corporation, Elizabeth, N. J. The tribute reads as follows:

Charles Wesley Sylvester, we of The Ship salute you for distinguished service. . . .

Vocational education, the elder, yet ever the youngest daughter of education, first attracted you, 34 years ago, in the guise of manual training. You have been faithful to her, serving her, and in serving her, you have unknowingly served your country.

Because of your faithfulness, our country today is being swiftly and gloriously armed and fitted with accouterments that will resist, divert, and punish arrogant aggressors that would ignominiously degrade and fetter her.

In this, your accomplishment — vocational education — stands out, now as it did in previous ages, regarded breathlessly and with awe by its very mother, education, and her other daughters, the professions and industry.

Distributing the prizes

Your 34 years of faithfulness and service to vocational education should also be likened to regimental colors, proudly borne aloft for all the world to see, by your hosts of friends. Its waving streamers bear record of your fields of service. Emblazoned on the streamers are the names of Norfolk, Pittsburgh, Indianapolis, Springfield, Hammond, and for the Federal Board of Vocational Education, Boston, Washington, and Chicago. It was on these fields that you built accordingly and carried forward to greater accomplishment.

Your natal state of Maryland and glorious Baltimore, whose director of vocational education you have been for the past twenty years, may have received the direct benefits of your wise counsel and direction, yet legions of men and women in all parts of our United States, now engaged in vital activities relative to the preservation of the American way of life, bear, because

(Continued on page 40A)

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

AIR COMPRESSOR
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

ALIGNING JIG — for connecting rods

ANVIL
- *a*) No. 100 or No. 125
- *b*) Rim

ARMATURE GROWLER AND TESTER

AXLE STANDS

BATTERY EQUIPMENT
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

BENCH
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

BLACKBOARD

BLOWTORCHES — 1-qt. size

BOOKCASE

BRAKE
- *a*) Adjusting stand
- *b*) Band-lining machine

BULLETIN BOARD

CABINETS
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

CHAIN HOIST — with overhead trolley and track

CHAIRS
- *a*) Teacher's
- *b*) For tables, or with tablet arms

CRANE — portable

CRANKSHAFT TRUING TOOL

CREEPERS

DESK — teacher's

DRILL
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ½ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

DYNAMOMETER — electric

FORGE — with blower and tools

FURNACES — gas

GREASE DISPENSERS

GRINDER
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

HONES — cylinder

JACKS
- *a*) Lever, 1½-ton
- *b*) Floor, roller

LATHE
- *a*) 11 in. by 4 ft., with motor, chucks, and attachments
- *b*) 16 in. by 6 ft., with motor, chucks, and attachments

PRESS
- *a*) Arbor
- *b*) 30 ton

SPRAY PAINTING OUTFIT

VALVE REFACING MACHINE

VULCANIZER
- *a*) Electric steam for tube work
- *b*) Small, hand

WELDING OUTFIT — with tanks, gauges, and cutting torch

WHEEL ALIGNMENT
- *a*) Gauge
- *b*) Test table

Automotive Shop—Small Tools

ABRASIVE — rubstone for cleaning castings in foundry

ALCOHOL TESTER

BATTERY
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *j*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

BITS
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

BOLT CUTTER — 24 in. and 36 in.

CALIPERS — 6 in. inside and outside

CANS
- *a*) Oil, 1/3 pt.
- *b*) 1 gal., gas, safety
- *c*) 5 gal., gas, safety
- *d*) 5 gal., kerosine
- *e*) Waste

CHECKS — tool, 1000, blank

CHISELS
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 3/8 in., 5/8 in., 3/4 in., 1 in.
- *c*) Diamond point

COMBINATION SQUARES — 12 in.

COTTER-PIN EXTRACTOR

DIVIDERS — 6 in. and 10 in.

DRILL SETS
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

FILE CARDS

FILE HANDLES — assorted

FILES
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

FIRE EXTINGUISHERS — Pyrene and Acid

FIRST-AID CABINET AND SUPPLIES

FLOOR BRUSHES — 18 in.

FUNNELS — tin, assorted sizes

GAUGES
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

GLASS CUTTERS

GOGGLES

GREASE GUNS — plain and pressure type

HAMMERS
- *a*) Ball peen, 4 oz.
- *b*) Ball peen, 1¼ lb.
- *c*) Ball peen, 2 lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

LADLE
- *a*) 3-in. bowl
- *b*) 6-in. bowl

LAMPS — extension, with reels

LEAD POT — gas

MAGNET CHARGER

METERS — volt and ammeter test

MICROMETERS
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

MOLDS
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

OILSTONE

PIPE TAPS — 1/8 in., ¼ in., 3/8 in., and ½ in.

PLIERS
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Roundnose

PULLERS
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

PUNCHES
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

PUTTY KNIVES

(Continued on page 39A)

Train them with the tools They'll be using on the job!

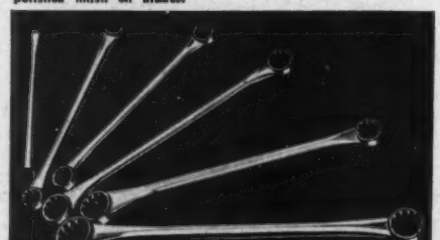
Early impressions are lasting. There is every advantage in having your students work with fine tools during the formative training period. They get the "feel" of precision, speed and power. They gain enduring respect and preference for the quality of tools that will help advance them in their craft.

Snap-on tools are endorsed and used for maintenance by every leading American airline . . . they are chosen for production in foremost aircraft plants . . . they are helping speed output in vital defense factories . . . for 23 years the name "Snap-on" has meant tool leadership in the automotive industry.

Catalog showing the complete Snap-on line of more than 3,000 tools, and information on any tool subject, is yours for the asking.

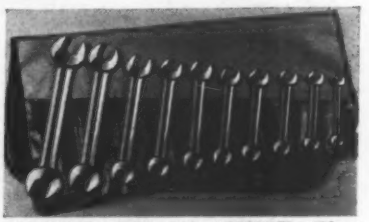
Available only on priorities. **Because of the urgent requirements of our armed forces and war industries, Snap-on tools are now available only on priorities. Immediate delivery on all items cannot be guaranteed, but we will cooperate to the best of our ability.**

"SUPREME" CHISELS AND PUNCHES. Made of alloys which provide great strength and toughness, and scientifically tempered for long life. Will out-perform and out-last similar tools made of ordinary steels. The sanded finish square handles with rounded corners provide firm grip and solid drive, polished finish on blades.



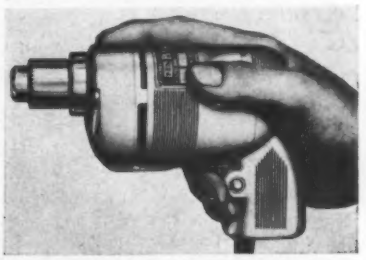
15° ANGLE BOXOCKET WRENCHES. Straight handles with heads set at 15° angle. Straight handle permits use in places where an offset would be awkward, while angle head provides clearance together with long direct pulling leverage. Different heads on each end make each handle do double duty. Sizes range from 5/16" to 1¼".

NUCUT FILES. Long a favorite with mechanics because of uniform high quality. Made from high grade alloy steel of special formula, Nucut files will continue to do good cutting long after ordinary files are worn smooth.



"SUPREME" OPEN END WRENCHES. Thinner head design—narrower jaws—non-slip handle—greater strength with lighter weight . . . Supreme wrenches offer these distinct advantages which make work easier and more accurate. Available in a wide range of sizes.

GEAR PULLER. Locks securely in any position. Jaws reversible for inside or outside holds. Made in two models to cover entire range of gear sizes, and other parts such as pitman arms, tie-rod ends, etc.



MIDGET ELECTRIC DRILL. Puts drilling speed and power into tightest spots! Full ¼" capacity but weighs only 2¾ pounds—only 2 1/16" wide. 100% anti-friction ball and needle roller bearing construction. Switch trigger fitted with lock pin for continuous operation.

Snap-on Tools

THE CHOICE OF BETTER MECHANICS

SNAP-ON TOOLS CORPORATION

8066-28th Avenue, Kenosha, Wisconsin

Why Every Auto Mechanics Class Should Have These Two Books

HERE are the two most complete auto repair guides in existence. Absolutely up-to-date and correct to the last turn of a bolt. Warranted to tell you, via simple step-by-step procedure, exactly how to repair, tuneup or service any model or make car or truck built in the past 8 years! (All passenger car models — 1935 through 1942 — all truck models — 1936 through 1942.)

These two big books, page size 8½" x 11", are based on each auto manufacturer's own official shop manuals. In addition, **MoToR's Truck Repair Manual carries 257 pages of repair and tuneup information on Diesel Engines alone.** None of this material has ever before appeared in print. Whether you are student or teacher, these books are required reference works. Specially made to stand wear and tear in waterproof bindings, they lie flat at any page for working while you read. Why not mail the coupons below (one or both) and look them over now. Only after you are certain that you want to keep them, need you pay the small first payment. Published by MoToR, the Leading Automotive Business Magazine.

MoToR's TRUCK REPAIR MANUAL

Covers Every Truck Built Since 1936

904 pages, with 1400 pictures and diagrams. More than 300,000 essential facts, based on truck manufacturers own official shop manuals. Hundreds of copies already in use by U. S. Armed Forces, fleet owners and truck service men.

Covers these Gasoline Trucks: American-LaFrance, Armleder, Autocar, Available, Biederman, Brockway, Chevrolet, Clydesdale, Coleman, Condor, Corbitt, Dart, Day-Elder, Diamond T. Divco-Twin, Dodge, Duplex, Esco, Fageol, Fargo, Federal, Ford F.W.D., GMC, Gramm, Grass-Premier, Hahn, Hendrickson, Hug, Indiana, International, Kenworth, Kleiber, LaFrance-Republic, Le Moon, Mack, Mack, Jr., Marmon-Herrington, Menominee, Moreland, Netco, Oshkosh, Pak-Age-Car, Reo, Schacht, Sterling, Stewart, Studebaker, Ward-LaFrance, White, White Horse — DIESEL ENGINES: Hercules, Mack, Dodge, Buda, Cummins, GMC, — HESSELMAN ENGINES: Waukesha — DIESEL FUEL INJECTION SYSTEMS. American-Bosch, GMC, Ex-Cell-O, Cummins, Timkin, FUEL SYSTEMS, GOVERNORS, LUBRICATION SYSTEMS, COOLING SYSTEMS, IGNITION SYSTEMS, STARTERS, GENERATORS, CLUTCHES, TRANSMISSIONS, (all units from 2-speeds to 10-speeds), FRONT AND REAR DRIVING AXLES, TORQUE DIVIDERS, TRANSFER CASES, UNIVERSALS, BRAKES, etc.

MoToR's FACTORY SHOP MANUAL

Covers Every Car Built Since 1936

Over 600 pages, with over 900 pictures and diagrams. More than 200,000 essential facts based on auto manufacturers' own official shop manuals. Used all over the world.

Covers every model of all these passenger cars: American Bantam, Auburn, Austin, Buick, Cadillac, Chevrolet, Chrysler, Cord, De Soto, Dodge, Ford, Graham, Hudson, Hupmobile, Lafayette, La Salle, Lincoln, Lincoln Zephyr, Mercury, Nash, Oldsmobile, Overland, Packard, Pierce Arrow, Plymouth, Pontiac, Reo, Studebaker, Terraplane, Willys. Carries over 50 pages of carburetor text, charts, illustrations, covering all models. Over 450 charts, tables covering important specifications, clearances, measurements, arranged in handy form, including: TUNE-UP CHART; VALVE MEASUREMENTS; COMPRESSION PRESSURE; TORQUE WRENCH READING; STARTING MOTOR; ENGINE CLEARANCE; MAIN & ROD BEARING JOURNAL DIMENSIONS; GENERATOR; CLUTCH & BRAKE SPECIFICATIONS; FRONT END MEASUREMENTS, etc., etc. Detailed, pictured instructions on ENGINES; ELECTRIC SYSTEMS; FUEL SYSTEMS; COOLING SYSTEMS; LUBRICATING SYSTEMS; TRANSMISSIONS; WHEELS; FRONT ENDS; KNEE ACTION; SHOCK ABSORBERS; SPRING, BODIES; FREE WHEEL; UNIVERSALS; REAR ENDS, etc., etc.

FREE 7-DAY TRIAL

MoToR Book Dept., Desk 363A, 572 Madison Ave., New York, N. Y.

Rush me MoToR's 1943 TRUCK REPAIR MANUAL FOR 7 days' FREE EXAMINATION. If satisfactory, I will remit special school discount price of $7.20 (Foreign school price of $9.90, cash with order) within 30 days. Otherwise I will return book at end of 7 day trial period.

Name..... Age.....

Address.....

City..... State.....

Occupation .....

School Name & Address.....

☐ Check here if you enclose $7.20 ($9.90 foreign) and we will pay shipping costs. Same money-back guarantee applies.

FREE 7-DAY TRIAL

MoToR Book Dept., Desk 363B, 572 Madison Ave., New York, N. Y.

Rush me MoToR's FACTORY SHOP MANUAL for 7 days' FREE EXAMINATION. If satisfactory, I will remit special school discount price of $4.50 (Foreign school price, $5.40, cash with order) within 30 days. Otherwise I will return book at end of 7 day trial period.

Name..... Age.....

Address.....

City..... State.....

Occupation .....

School Name & Address.....

☐ **SAVE 35¢** Check here if you enclose $4.50 ($5.40 foreign) WITH coupon. We will then pay shipping costs. Same money-back guarantee applies.

(Continued from page 36A)

REAMER — spindle bolt
REAMER SETS
- *a*) Piston pin, ½ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

SAWS
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

SCALES
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

SCRAPERS
- *a*) Bearing
- *b*) Carbon

SCREW DRIVERS
- *a*) 6 in. and 12 in.
- *b*) Small combination

SCREW EXTRACTORS
SCRIBERS
SNIPS — tin, 3 in. straight and 3 in. curved
SOLDERING COPPERS — 1, 2, and 3 lb. with handles
SPRING SPREADERS
STAMPS
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

TAP-AND-DIE SETS
- *a*) Machine screw
- *b*) N.F. ¼ in. to 1 in.
- *c*) N.C. ¼ in. to 1 in.

TIRE TOOLS
TOOL KIT — metal box or canvas roll, empty
TWIST DRILLS — (extra sets) selected sizes
VALVE
- *a*) Grinders (hand)
- *b*) Spring lifters

WRENCHES
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., N.C. and N.F.
- *j*) Valve-tappet wrenches

Automotive Shop— Materials and Supplies

ACETYLENE GAS — in drums, for welding
ACID
ALCOHOL
BABBITT
BEARING BLUE
BEARING COMPOUND
BOLTS
- *a*) Machine, selected sizes
- *b*) N.F., selected sizes
- *c*) Stove, flat or round heads, selected sizes

BRAKE JUICE — ½-pt. cans
BRUSHES
- *a*) Paint
- *b*) Spark plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

CHAMOIS
COIL-SPRING ASSORTMENT
COPPER TUBING
COTTER PINS — assorted sizes
CROCUS CLOTH
DISTILLED WATER
DRAIN COCKS
ELECTROLYTE
EMERY CLOTH — Nos. 2/0, 0, ½, and 1
ENAMEL — AUTO PAINTING
GASKETS
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

GASOLINE
GREASE — cup, cans
KEROSINE
KEYS, WHITNEY — assorted
LACQUER — colors
LEAD
LUBRICANT — transmission
NAILS AND BRADS
NUTS
- *a*) N.F., castellated, square, hexagon, selected sizes and kinds
- *b*) N.C., square and hexagon, selected sizes
- *c*) Machine screw, selected sizes
- *d*) Wing, selected sizes

OIL
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

OXYGEN — in drums for lead burning
PIG LEAD
PISTON-RING COMPRESSORS
RADIATOR HOSE
RIVETS — brake lining, 5/16 in., ½ in., and ¾ in. long.
SANDPAPER — Nos. 2/0, 0, ½, and 1
SCREWS
- *a*) Flathead or roundhead, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron, or brass, selected sizes and kinds

SEALING COMPOUND
SHELLAC — ½-pt. cans
SHIM STOCK
SOAPSTONE
SOLDER — bar, wire, or self-fluxing wire
SOLDERING PASTE
SPELTER — for brazing
SPONGES — ½ lb.
STARTING CABLE
TACKS AND STAPLES — upholstery
TIRE
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

VALVE-GRINDING COMPOUND — coarse and fine
WASHERS
- *a*) Lock, assorted sizes
- *b*) Wrought iron

WASTE
WIRE — primary and secondary

WEIDENHOFF
Automotive - Aviation
SERVICE EQUIPMENT

The All-American Line-Up---

● **Generator, Starter and Magneto Test Benches —**

For bench testing all types of passenger cars and commercial vehicle generators and voltage regulators. Several models from which to choose. Capable of handling largest truck, bus and aircraft generators. Starting motors tested for free running and locked torque for electrical resistance and mechanical condition. Magneto test fixture available at purchaser's option.

● **Cyclone Battery Charger —**

A compact, portable unit for fast battery charging. Built-in analyzer gives immediate and accurate indications of battery condition. Four scales on meter. Meter can be used without interfering with charger operation.

● **Constant Potential Battery Charger —**

A highly efficient motor — generator set which can be had with or without charging panel. As many batteries may be placed on the charge panel as desired providing total charge rate of all batteries is within full output of generator.

● **Distrib-U-Scope —**

This precision engineered and built unit affords a complete picture of ignition distributor performance at a glance. No meters to read. Checks for correct cam angle, governor advance, vacuum control, breaker point condition, etc.

● **Magnetizer —**

A comprehensive unit for charging most types of magneto magnets including two, four and eight pole rotors of revolving magnet type magnetos.

● **Engine Analyzers —**

Engine analyzers and testers to fill every need. Compact, portable sets for individual mechanic. Complete deluxe tune-up equipment also available.

● **Mechanics Service Tools —**

Complete line of timing lights, vacuum gauges, compression gauges, ammeter, voltmeter test instruments, tension scales, cell testers, armature growlers, etc.

● **Ignition Coil Tester —**

Designed to test a coil completely — on or off motor vehicle — hot or cold. Tests high and low speed conditions, insulation for leakage, continuity and "opens" in primary and secondary.

● **Condenser and Resistance Tester —**

Complete tests of all condenser conditions. Also tests for shorts, break-down, leakage and series resistance. Ideal for checking fuel gauge, radio antennae and other electrical devices.

● **Ammeter, Voltmeter and Rheostat —**

Incorporates an ammeter and voltmeter plus variable resistances with ability to carry ample current. Ideal for checking voltage and current regulators.

● **Puller Press —**

Ideal for removing and replacing bearings, bushings, races, slip rings, end caps, Bendix drives and gears. Saves time, labor and prevents breakage of parts.

● **Mica Undercutter and Armature Stand —**

This is a heavy duty, precision undercutter which will give years of accurate, dependable service. Furnished with ten saw-type cutters, three each .015 in., and .020 in., and four .025 in. Two or more cutters can be mounted on spindle for wider cuts.

● **Vacuum, Compression and Fuel Pump Tester —**

Edge type vacuum and compression gauges. Low reading pressure gauge for fuel pump test, muffler back pressure, etc.

● **Exhaust Analyzer —**

A means of accurately and quickly determining carburetion condition. Portability of unit permits removal from cabinet for road testing.

● **Electronic Tachometer —**

A precision unit which has many and varied uses in engine tune-up work. Precise calibration accomplished by use of a synchronous motor. Ideal for synchronizing dual carburetors, and other factors effecting engine performance.

Write for Particulars

AUTOMOTIVE SERVICE WEIDENHOFF EQUIPMENT AVIATION

Buy More War Bonds

JOSEPH WEIDENHOFF, INC.
CHICAGO, ILL.

(Continued from page 36A)

of men like you, the hallmark of efficient and qualitative accomplishment.

Your unselfish service as treasurer of the American Vocational Association for the past 14 years is another exemplification of your sterling character.

To most of us you have been an ever faithful comrade and friend; tolerant, ever helpful, encouraging, sympathetic and understanding. You have given us generously of yourself.

May your future years be many, and may they always be filled with the satisfaction that having only one opportunity "to tread this path," you have always tried to "walk well."

Charles Wesley Sylvester, again we, the members of The Ship, salute you.

Given under our hand and seal this fourth day of December, A.D. 1942, during the thirty-sixth annual convention of the American Vocational Association, held in the city of Toledo, Ohio.

Ship's Committee on Recognition of Valiant Service:

(Signed) John Backus
(Signed) Ed. Cherry
(Signed) L. L. Simpson
(Signed) D. N. McCarl
The Ship
(Signed) Chas. Roper, First Mate
(Signed) John Claude, Deck Officer
(Signed) Ralph Foss, Spokesman
(Signed) L. H. Dennis, Chief Pirate

(Continued on page 44A)

Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH GRINDER
BENCHES — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably they should have electrical outlets
BITS
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in. by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw driver, ¼ in.

BLACKBOARD — permanent or portable
BLOWTORCHES — 1-qt. size
BOOKCASE
BRACES — ratchet type, 8-in. swing
BULLETIN BOARD
CABINETS — wood or metal for filing class records, instruction sheets, drawings, etc.
CHAIRS — teacher's and tablet arm
COMPASS SAW
COIL
- *a*) Spreader
- *b*) Taper
- *c*) Winder

DESK — teacher's, with drawer compartments
DRILL
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to ⅜ in. by 32nds

DRILL PRESS
- *a*) Bench, hand, or power driven
- *b*) Heavy, power driven

FILES
FIRST-AID CABINET AND SUPPLIES
HACK SAW
- *a*) Blades, 10 in., 24 tooth
- *b*) Frames, adjustable

HAMMERS
- *a*) Claw, 12 oz.
- *b*) Machinist's, ball peen

HICKEY — ½ in. and ¾ in.
LATHE
- *a*) Engine, 10-in. or 12-in. swing, 6 ft. or 8 ft. long
- *b*) Speed

PLIERS
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side cutting, 6 in.

PUNCH — for metal molding
PUNCHES — assorted
REAMERS
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

RULES
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

SCREW DRIVERS — 3 in., 5 in., and 8 in.
SHEARS — for cutting metal molding
SOLDER DIPPERS
SOLDERING COPPERS
- *a*) Assorted
- *b*) Electric
- *c*) Handles

STOCKS AND DIES — for pipe threads, ½ in. to 1 in.
VISES
- *a*) Machinist's, 4 in.
- *b*) Pipe

WRENCHES
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop—Supplies

ABRASIVE CLOTH — Aluminum oxide, 1, 1½, and 2 in. wide
ARMORED CABLE
- *a*) 2 wire, No. 14, single strip
- *b*) 3 wire, No. 14, single strip
- *c*) Box connectors

ATTACHMENT PLUG
BAR HANGERS
BATTERIES — dry cells
BATTERY ACID — 1.300
BATTERY SEALING COMPOUND
BOX CLEATS
BRADS — ¾ in., No. 19, and 1½ in., No. 16
BRAKE LINING — ¼ by 2 in.
BRUSHES — carbon, for motors and generators
BURGLAR CONTACTS
- *a*) Open circuit
- *b*) Closed circuit

BUSHINGS
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

BUZZERS
CLEATS — unglazed porcelain, 2 wire
CLIPS — test, with insulators, Universal, Nos. 22, 23, 24, and 25
COMMUTATOR CEMENT
CONDUIT
- *a*) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

CONDULET
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

DOOR OPENERS — mortised
FISH PAPER — .0125 in. thick
FIXTURES — brass chain, suspension
FIXTURE STUDS
FUSES
- *a*) Plug type, renewable, 125 volt, 15 amp.
- *b*) Cartridge type, renewable, 125 volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

GROUND CLAMPS — ⅜ in. to 1 in., assorted
HICKEY GRIPS — ½ in. and ¾ in.
LAMPS
- *a*) Carbon, 220 volt, 60 watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

LEATHER NAIL HEADS
LUGS — 25 and 50 amp.
LUMBER — 2 by 4 in. by 14 ft., No. 1, white pine dressed, 4 sides
MOLDING
- *a*) Metal
- *b*) Metal, fittings — crosses, T's, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches

NAILS — roofing
NUTS — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20
OUTLET BOXES — 4 in. square, with one round blank cover, and one cover with bushed opening
PIPE STRAPS — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.
PUSH BUTTONS
- *a*) Return call, 3 point
- *b*) Single

RECEPTACLES
- *a*) Flush, duplex
- *b*) Porcelain cleat, 660 watt, 250 volt
- *c*) Concealed
- *d*) Covers

RECTIFIERS — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
RELAYS — Dixie
RESISTANCE BOARDS — for testing
RESISTANCE UNITS — 125-ohm
RHEOSTATS
- *a*) Compression, 275 watt
- *b*) Field, for shunt and compound motors

ROSETTES — wood
ROTARY CONVERTER — 5-kw. capacity, 3 phase a.c., 110 volt d.c.
SCREWS
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ⅜ in., 8–32 by ½ in., 8–32 by 1 in., 10–32 by ⅜ in., 10–24 by ⅜ in., 10–24 by ¾ in., 10–32 by ¾ in., 12–24 by 1 in.
- *c*) Machine, brass, roundhead, 4–36 by ¼ in., 6–32 by ½ in., 6–32 by ¾ in., 8–32 by ½ in.
- *d*) Wood, flathead bright, No. 5 by ¾ in., No. 8 by ½ in., No. 8 by ¾ in., No. 8 by 1 in., No. 7 by 1½ in., No. 8 by 1½ in., No. 7 by 2 in.
- *e*) Wood, roundhead blued, No. 7 by 1 in., No. 8 by 1½ in., No. 10 by 1½ in., No. 7 by 2 in.

SLEEVING — No. 1, white; No. 1, blue; and No. 1, red
SOCKETS
- *a*) Brushed, brass pull chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

SOCKET CAPS — ¼ in. and ⅜ in. bushed
SOLDER WIRE — 50/50, size No. 10
SOLDERING PASTE — 2-oz. cans, noncorrosive
SOLDERING SALTS — 1-oz. cans, noncorrosive
SPEED COUNTERS — 0–9999
SPLIT KNOBS — porcelain
SPRING BALANCES — 0–30 lb.

(Continued on page 42A)

GENERAL ELECTRIC EDUCATIONAL SERVICE

Owing to the utilization of our facilities for war work, the War Production Board priority requirements may make it impossible for us to make the deliveries you desire. However, there are no priorities on plans for your future needs.

Laboratory Apparatus

General Electric engineers will gladly recommend apparatus to meet your special conditions if you will give them such details as: type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company, or write direct to the Educational Sales Section, General Electric Company, Schenectady, N. Y.

Usually, the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.

Where standard apparatus is not entirely suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185, illustrates and describes G-E apparatus particularly adapted for laboratory use.

Electrical Laboratory and Shop Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62 will be particularly useful. In this booklet will be found, listed in three different groups, equipment to meet a wide range of requirements. For the elementary courses, a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well-balanced laboratory equipment which will permit a wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Illustrated Lecture Service

Descriptive manuscripts, accompanied by suitable slide films, are available for general use, free of charge. The slides are arranged in accordance with their location in the manuscript. A few lectures are available on glass lantern slides only, but the majority are available on 35-mm standard film.

These lectures are particularly valuable to schools and colleges, technical societies, chambers of commerce, and boards of trade. While the lectures in a few instances cover the subject in a purely technical manner, most of them are so prepared as to be interesting to the general public, and in these the subjects are treated in a more popular way.

All text and slide films are furnished without charge. The text and slide films may be retained by the user, but all glass slides must be returned with transportation prepaid.

Photo News Service

For many years, General Electric has furnished some 5000 schools and colleges in this country and abroad with semimonthly news posters which tell briefly, authoritatively, and interestingly the story of the accomplishments of electricity — the most recent developments in the research laboratories of the Company — experiments with man-made lightning — electric ships, spectacular lightning, precision instruments, short-wave radio, X ray. These posters have come to be almost standard equipment for many general-science teachers. They are published on the 1st and 15th of every month from October 1 through January 15. The service is free. Teachers only should apply for it, and should give their school address.

Motion-picture Films

An extensive motion-picture service is maintained by the General Electric Company for the purpose of disseminating throughout the United States reliable information concerning important developments in the electrical field.

The service provides motion-picture films by means of which the details of manufacture and the use of electric products are presented in a highly instructive manner.

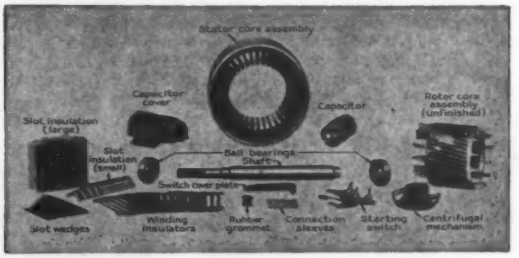
Silent pictures are furnished either in 35-mm, safety or nitrate stock, and 16-mm safety stock.

All sound pictures are available in 16-mm sound on film, safety base. Many are also available in 35-mm size. Films are lent free of charge with transportation charges paid by user.

These films are listed and described in General Electric's motion-picture catalog, GES-402, copies of which may be had upon application to the nearest G-E sales office. Requests for the use of motion-picture films should be addressed as directed in that publication and will receive the attention of a specialist.

Educational Construction Projects

The General Electric Company, in carrying out its educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop since they



A typical motor kit, exclusive of castings

are not merely assembly projects, but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The G-E projects have the following standard ratings and are completely described in the G-E bulletins indicated:

(1) ¼-hp, single-phase, 60-cycle, 110-volt capacitor-motor, GEA-3514.

(2) ½-hp, single-phase, 60-cycle, 115/230-volt capacitor-motor, GEA-3526.

(3) ½-hp, 3-phase, 60-cycle, 220-volt motor, GEA-3542.

(4) 250-watt, 125-volt, compound-wound d-c generator, GEA-2289.

(5) 1½-kva, 220-55/110-volt, 60-cycle air-cooled transformer, GET-569.

GENERAL ELECTRIC

SCHENECTADY, N.Y.

Sales Offices in Principal Cities

IDEA
for War-Work Training

—Photo Courtesy Vega Aircraft Corporation.

Teach KESTER Soldering in Special Courses for Women

IN important war production jobs, women have taken to soldering like ducks to water. In plants everywhere, they're working with Kester Flux-Filled Solders, making fine records, earning good pay, and releasing men for the armed forces. Be sure to include soldering — with Kester Flux-Filled Solders — in your special shop courses for women.

Kester Flux-Filled Solders, standard in industry for 44 years, are the favored soldering material for training in service and public schools. Not only do they get better results, *quicker*, but they eliminate the need for separate fluxes. There's never any guesswork about the kind or quantity of flux to use, no danger of spattered or marred floors and benches — with Kester!

Skill in soldering is easily acquired with Kester Flux-Filled Solders. Students learn faster, they do better work, which makes your job easier and reflects credit on you.

It's a valuable skill to have. Teach it, in both regular metalcraft classes and special courses for war production training. But teach it with industry's standard — Kester Flux-Filled Solder! Order from your wholesaler.

KESTER SOLDER COMPANY
4257 Wrightwood Ave. Chicago, Illinois

Eastern Plant: Newark, N. J.
Canadian Plant: Brantford, Ont.

KESTER
FLUX-FILLED SOLDER

(Continued from page 40A)

STARTING BOXES
- *a*) For compound motors, various makes
- *b*) For shunt wound, 1 h.p., 110-volt motors. Overload release
- *c*) For shunt wound, 1 h.p., 110-volt motors. No voltage release
- *d*) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors

STORAGE BATTERIES — 6 volt

SWITCH
- *a*) Battery, 4 point
- *b*) Bases, porcelain, for 10-amp. switches
- *c*) Boxes, 2¾ in. deep
- *d*) Entrance, safety, 2 pole, 30 amp., with 2-branch lighting circuits
- *e*) Entrance, safety, 3 pole, 30 amp., 250 volt
- *f*) Flush, push button, S.P., D.P., 3 way, 4 way
- *g*) Surface, S1, S3, and S4
- *h*) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- *j*) Surface, snap, electrolier
- *k*) Surface, snap, S.P.D.P., 3 way, 4 way

SWITCHBOARD — as required

TACKS — double-pointed No. 10

TAPE
- *a*) Friction, ½-lb. rolls
- *b*) Rubber, ½-lb. rolls

TELEGRAPH SETS — including sounders, keys, and relays

TELEPHONES
- *a*) Complete bridging, independent phones
- *b*) Couch vestibule telephones
- *c*) Receivers, transmitters, induction coils, condensers, and bridging switch hooks

TRANSFORMERS
- *a*) Bell ringing, 6, 8, 14 volt
- *b*) Single phase, 110–220 volt, S.K.V.A.

TUBES — porcelain, 5/16 by 3 in., 5/16 by 5 in., and 5/16 by 10 in.

TUBING — flexible nonmetallic, ¼ in. and ⅜ in.

WASHERS
- *a*) Iron, ¼ in. and ⅜ in.
- *b*) Brass, ¼ in. and ⅜ in.

WIRE
- *a*) Annunciator No. 18 or No. 20
- *b*) Fixture, No. 18, single yellow, with marker
- *c*) Rubber covered, solid copper, No. 10, black
- *d*) No. 10, white
- *e*) No. 14, black
- *f*) No. 14, white
- *g*) Rubber covered, No. 16, brewery cord
- *h*) No. 18, lamp cord, green and yellow
- *j*) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop— Motor and Testing Equipment

ANNUNCIATORS
- *a*) Automatic needle drop
- *b*) Gravity drop
- *c*) Manual needle drop

ARMATURES — burnt out, for repairing

BATTERY CHARGER — commercial

CIRCUIT BREAKERS
- *a*) Air, single pole, overload, 25 amp., 550 volt
- *b*) Air, single pole, underload, 15 amp., 550 volt

CONTROLLERS
- *a*) For multiple-speed motor
- *b*) For 1 h.p., 110-volt series motors

GENERATORS
- *a*) Motor-generator set, 10 h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
- *b*) Generator, 6-volt d.c. coupled to an a.c. motor for 6-volt circuit testing
- *c*) Auto generators of different makes

GRAVITY CELLS

MAGNETS — testing, 10,000 ohm

METERS
- *a*) Ammeter, standard, 60 amp., a.c.
- *b*) Ammeter, standard, 60 amp., d.c.
- *c*) Ammeter, student, 60 amp., a.c.
- *d*) Ammeter, student, 60 amp., d.c.
- *e*) Voltmeter, standard, 0–10 volt,
- *f*) Voltmeter, standard, 110–220 volt, d.c.–a.c.
- *g*) Voltmeter, standard, 125 volt, a.c.
- *h*) Voltmeter, standard, 125 volt, d.c.
- *j*) Voltmeter, student, 110 volt, d.c.
- *k*) Voltmeter, student, 110 volt, a.c.
- *l*) Wattmeter, standard, 110–220 volt, 30–60 amp., d.c.–a.c.
- *m*) Wattmeter, student, 110–220 volt, 30 amp., a.c.–d.c.
- *n*) Watt-hour meter, 125 volt, 5 amp., a.c., single phase, various makes

MOTORS
- *a*) Auto starter, different makes
- *b*) Burnt out, fractional h.p., 110 volt, 60 cycle, for repairing
- *c*) Compound, 1 h.p., 110 volt, d.c.
- *d*) Multiple speed, 1 h.p., 3 phase, 220 volt
- *e*) Series, 1 h.p., 110 volt, d.c.
- *f*) Shunt, 1 h.p., 110 volt, d.c.
- *g*) Split phase and repulsive, a.c., 110 volt, single phase, assorted
- *h*) Split phase induction motors, fractional h.p., 110 volt, 60 cycle, different makes
- *j*) 3 phase, 1 h.p., a.c., 220 volt, various makes
- *k*) 3 phase, 2 h.p., 220 volt, a.c., various makes
- *l*) Universal, fractional h.p., 110 volt, different makes
- *m*) Universal, variable speed, ½ h.p.

PLATFORM SCALE — 100 lb. capacity

The World's STANDARDS OF ACCURACY

for Instruction, Research, Industry

The widespread use of WESTON instruments in vocational education has become a fixed principle...primarily because these are the measurement standards so widely used throughout industry. Thus the student becomes thoroughly familiar with the instruments he will use throughout his industrial career. They are preferred, too, because they inspire students to be more exacting in their work, and because they represent a truly sound investment...combining ruggedness, dependability and long life.

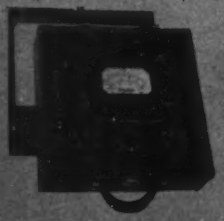
Following is a condensed listing of the WESTON instruments available . . . also are illustrated a few of the models most widely used in educational work. Complete information on any WESTON instrument is available and will gladly be sent on request. Write to... Weston Electrical Instrument Corporation, 595 Frelinghuysen Avenue, Newark, New Jersey.

Model 45
D. C. Instruments

Sturdy portable test instruments for accurate testing. Magnetically shielded, polished hardwood case. Accuracy ½ of 1%. Hand calibrated mirror scales of long length. Available in Voltmeters, Ammeters, Milliammeters, Volt-Ammeters.

Model 430
Portable, Precision A. C. and D. C. Instruments

Universally used in schools and industry wherever rugged, portable instruments are required for general testing. Hand calibrated, mirror scales with knife-edged pointers.



Model 785
Industrial Circuit Tester

Provides 27 ranges . . . all the ranges necessary for voltage, current and resistance measurements in signal, control and electronic circuits, or wherever else high sensitivity is a factor.

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

RELAYS
Sensitive and Power Uses – Current and Voltage Types

INSTRUMENT TRANSFORMERS
Portable and Switchboard – Potential and Current

AIRCRAFT INSTRUMENTS
Tachometers, Temperature Indicators, Radio Compass Indicators, Ammeters, Voltmeters, etc.

ELECTRIC TACHOMETERS
A.C. and D.C. Types – Remote Indicating

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

PHOTOELECTRIC CELLS
"Photronic" Cells – Dry Disc Type

PHOTOELECTRIC CONTROL DEVICES
"*Photronic" Cell Controls, Illumination Controls, Smoke Alarms, Industrial Controls

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters. Sight Meter, Exposure Meters

TEMPERATURE INDICATING INSTRUMENTS
ELECTRICAL TYPE – Remote Indicating
BIMETALLIC DIAL TYPE – Laboratory, Industrial

INSTRUMENT ACCESSORIES AND PARTS
Shunts, Cables, Resistors, Switches, Binding Posts, Leads, Multipliers, Adapters, Radio Plugs, etc.

STANDARD CELLS

**Photronic – A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

WESTON *Instruments*

Model 489 and 528
Small A. C. and D. C. Instruments

Small, sturdy, inexpensive . . . for all-around A.C. and D.C. testing where moderate accuracy is sufficient. Available in Voltmeters, Ammeters, Milliammeters. A.C. models available in single, double and triple ranges.

Model 155
A. C. Instruments

Single or multi-range instruments, movable iron type, for general testing where high accuracy and long scale length are desired. Ammeters available with ranges up to 500 amperes, self-contained; Voltmeters up to 750 volts, self-contained. Sturdy, hardwood cases.

Model 623
A. C. Clamp Ammeter

Current readings obtained simply by placing clamping jaws around conductor. Circuits never disturbed. 6 current ranges. High insulation for complete protection.

Model 772
Super-Sensitive Radio Set Tester

Sensitivity of 20,000 ohms per volt. Adequate voltage, current, resistance and output meter readings for servicing receivers, transmitters, P. A. systems, vacuum and cathode ray tube equipment, communications circuits, etc.

(Continued from page 40A)

The distribution of prizes then took place to the usual delight of all.

♦ The twenty-sixth annual convention of the New Jersey Vocational and Arts Association was held at the McAlpin Hotel, New York City, January 14, 15, and 16, 1943.

The supervisors and administrators met Thursday at 8:30 p.m. John A. McCarthy, assistant commissioner of education in charge of vocational education, was the chairman. The speakers were Howard Dare White, assistant commissioner of education in charge of secondary education; Dr. Ronald W. Kent, assistant director, Essex County Vocational Schools; and Seymour Williams, architect, inspector of school plans and buildings, New Jersey Department of Public Instruction. They discussed the following subjects: "The Victory Corps and Preinduction Training Programs in the Schools of New Jersey"; "Plans for the Participation of the New Jersey Trade and Industrial Schools in the Victory Corps Program"; and "Some Problems of Planning and Construction of Vocational, Industrial Arts, and Home Economics Facilities."

The Nu Chapter of the Epsilon Pi Tau Fraternity, under the chairmanship of L. Omer Asher, met on Friday at 10:00 a.m.

John McCarthy was the toastmaster at the informal dinner held Friday at 7:00 p.m. Brigadier General S. G. Henry, Commandant, Armored Force School, Fort Knox, Ky., gave the main address.

At the industrial-arts session held on Saturday morning, Harry Lesslie, Trenton, was chairman. Frank Moore, director of industrial arts, Public Schools, Cleveland, Ohio, was the principal speaker and he discussed "Industrial Arts and the War Effort in the Mid-Western States."

J. Ernest Jones, Verona, was chairman of the Boys' Vocational session Saturday morning at which G. A. McGarvey, agent for industrial education, Federal Security Agency, Washington, D. C., gave an address on "War-Production Training."

The printing session on Saturday morning was under the chairmanship of Stanley E. Griffith, president of the New Jersey Printing Teachers' Guild.

At this meeting Harold W. Bilyieu, vice-president of the New York Printing Teachers' Guild, gave an address on "Benjamin Franklin, an Influence for 1943."

Harry L. Gage, vice-president of the Mergenthaler Linotype Company, spoke on "The War's Effort on Graphic-Arts Education."

At the convention luncheon and business meeting held Saturday at 12:30 p.m., L. H. Dennis, executive secretary, American Vocational Association, gave an address on "Frontier Problems in Education."

James E. Hopkins, president of the New Jersey Vocational and Arts Association, presided at this luncheon meeting.

♦ Because of the difficulty of securing suitable accommodations it seems doubtful at the present time whether the Michigan Industrial Education Society will hold its usual annual convention.

Probably a summer meeting might be arranged.

♦ The Association of Teachers of Industrial and Practical Arts in day high schools was formed recently by New York City shop teachers.

The organization is still in temporary form, and a meeting to establish a permanent organization will be held in March.

Temporary officers are: Harold E. Taylor, Brooklyn Technical High School, president; Charles E. Jordan, Stuyvesant High School, vice-president; Abner Rosenblum, Benjamin Franklin High School, secretary; and Alfred Schaefer, Stuyvesant, treasurer.

The chairman of the nominating committee is John A. Vomacka, Stuyvesant High School.

♦ The industrial-arts teachers of Newark visited the classes and shops of the Casey Jones School of Aeronautics at Newark, N. J., on December 5.

Mr. Norman Potter, the vocational director for Casey Jones, directed the tour through the school.

Since the high schools of Newark have received another order for model planes from the Navy, the information received during the visit will be of great value to the teachers who have classes in which the planes for the Navy are to be built.

—H. G. Stintsman

♦ At a recent meeting held in Harrisburg, Pa., Dr. Shriver L. Coover, director of industrial arts at State Teachers College, California, Pa., was elected president of the industrial-arts division of the Pennsylvania State Education Association.

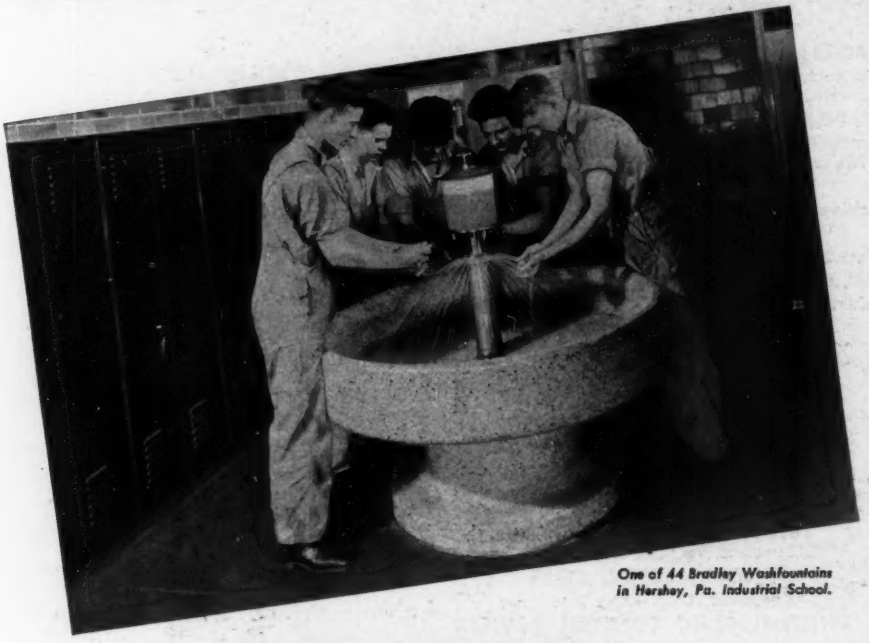
As president of the organization, Dr. Coover will have charge of the speakers and program for the summer meetings of the industrial-arts section of the Pennsylvania Vocational Association. He will also be in charge at the annual meeting held next December at Harrisburg.

While in eastern Pennsylvania, Dr. Coover visited the Middletown Air Depot with Mr. Ray Evans, Civilian Training Administrator. This plant is one of the Army's eastern supply and aircraft servicing centers.

—Donald Maley

♦ The decreased membership among upperclass students naturally resulted in a decreased number of men eligible for membership in Phi Chapter of Epsilon Pi Tau. In addition to the men initiated Leonard Rascoe was accepted. He was unable to attend the initiation ceremonies and banquet which followed due to the difficult travel condi-

(Continued on page 57A)



One of 44 Bradley Washfountains in Hershey, Pa. Industrial School.

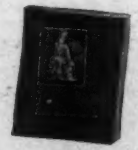
PROPER WASHING IS ESSENTIAL TO GOOD WORKMANSHIP

In the many schools, colleges and institutions, where modern Bradley Washfountains are installed—instructors consider good washing facilities important for two reasons.

FIRST, because good workmanship in the industrial and shop departments includes care of tools, orderliness and cleanliness.

SECOND, sanitary washing facilities reduce chance of skin affections.

Bradley Washfountains encourage regular washing—clean *running* water is furnished each student—no contaminating water collects, for the bowl is self-flushing. Bradleys provide more facilities in a given space,—8 to 10 wash simultaneously. Less water is consumed and only one-fifth as many piping connections are required because each Bradley takes the place of 8 to 10 "single-person" wash basins . . . Recommendations by our Washroom Consultants and copy of our catalog 4010 are yours for the asking . . . BRADLEY WASHFOUNTAIN CO., 2269 W. Michigan Street, Milwaukee, Wis.



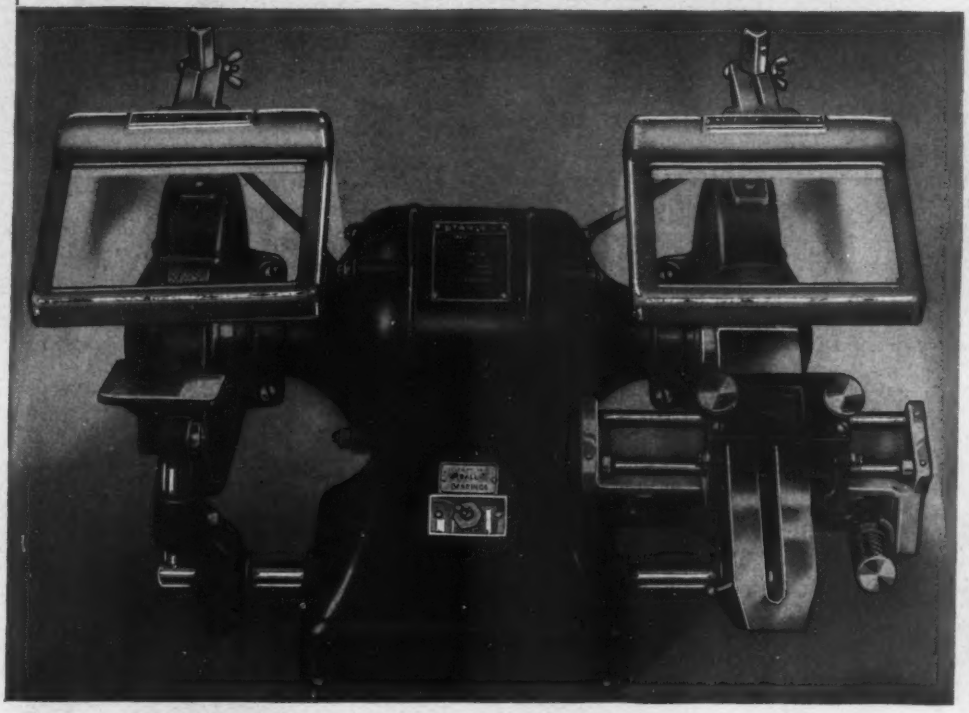
Catalog 4010 will be mailed on request.

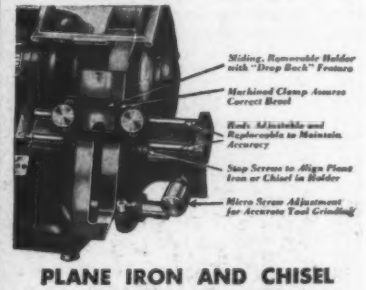
BRADLEY Washfountains

STANLEY

ELECTRIC TOOLS FOR SCHOOL SHOPS

TRADE STANLEY MARK



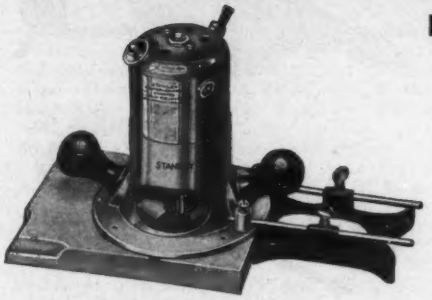

Sliding, Removable Holder with "Drop Back" Feature
Machined Clamp Assures Correct Bevel
Rods Adjustable and Replaceable to Maintain Accuracy
Stop Screws to Align Plane Iron or Chisel in Holder
Micro Screw Adjustment for Accurate Tool Grinding

PLANE IRON AND CHISEL GRINDING FIXTURE

Standard equipment with the No. 677 Grinder, keeps edge tools accurately beveled. Takes plane irons up to 2⅜" wide and chisels of any size. Micro screw feed adjustment.

STANLEY "FLUD-LITE" EYE SHIELD

Effective eye-protection combined with better vision. Two light bulbs with reflectors floodlight work area, help prevent injuries. Adjustable up and down, and tilts to suit operator's position. Cannot be moved to non-guarding position without dismantling. Standard equipment on No. 677 Grinder. Can be attached to all similar bench or belt-driven grinders.



No. 677 EDGE TOOL GRINDER

Every wood-working shop needs this improved, full ball bearing Bench Grinder. Powered by a ⅓ H.P. induction motor, fully enclosed, it operates at the correct speed for edge tool grinding. Equipped with "Flud-Lite" Eye Shields, one Adjustable Tool Rest, and the Plane Iron and Chisel Grinding Fixture.

HAND ROUTER No. 10

Fast – 18,000 R.P.M. – assuring a smooth finish that makes sanding practically unnecessary. For Shaping, Inlay Work, Routing, Templet Work, Veining, Grooving, Rabbeting, Corner Beading, etc. The power unit may also be quickly attached to a Beading and Fluting unit or to a shaper table. Provides a great variety of practical cuts and a wide range of decorative operations at a very low cost.

BE SURE YOU HAVE THESE STANLEY CATALOGS

No. 67 STANLEY ELECTRIC TOOL CATALOG

Describes and illustrates the complete line of Stanley Electric Drills, Saws, Unishears, Grinders and other tools. Write for a copy.

No. 605 ROUTER-SHAPER CATALOG

Describes Stanley Router-Shapers, and all the various attachments and applications. Keep a copy on hand for reference.

STANLEY ELECTRIC TOOL DIVISION EDUCATIONAL DEPARTMENT
THE STANLEY WORKS, NEW BRITAIN, CONN.

MILLERS FALLS COMPANY

Greenfield Massachusetts

28 Warren St., New York City — 100 So. Jefferson St., Chicago, Ill.

MILLERS FALLS TOOLS SINCE 1868

Note: In view of the increasing shortage of tools as America's war effort progresses, it is to the advantage of every school shop to select quality equipment that will stand up in long, strenuous service. Choose Millers Falls tools, standard items in vocational training as well as in industry. Available through school shop suppliers everywhere. Write for catalogs.

HAND AND BREAST DRILLS — Straight and ratchet, enclosed gear, single and two-speed — 27 models. Bench drills and boring machines.

PLANES — An unbeatable line, developed through 74 years of quality tool-building. Many kinds and sizes — smooth, jack, fore, jointer, block, rabbet, router, rabbet and fillister, scrub, and scraper.

MITRE BOXES — Complete line of mitre boxes, metal-cutting boxes, portables, open fronts. Best known are the famous Goodell All-Steel and Langdon Acme — high quality, great value.

LEVELS — For every purpose and condition of service; 18 wood models, 5 iron, others.

BENCH GRINDERS — Complete line — ⅓ h.p. to full 1 h.p. All voltages, cycles, single or three-phase. Eye-shields, lights, pedestals.

ELECTRIC DRILLS — Complete line—3/16" to 1". Other portable electric tools in every speed and capacity: screw drivers and nut runners; grinders; hammers; saws; disc sanders; polisher. Stands, adapters, accessories.

HACK SAWS — Finest frames ever made, many sizes and styles. Blades for all uses: Tuf-Flex, general-purpose hand blade, super-tough, super-flexible, cuts thin-walled tubes or tough tool-steel rods without stripping or breaking. Blu-Mol Double-Life, sensational new blade with cutting edges on each side, now in widespread industrial use, should be demonstrated in every school shop.

PRECISION TOOLS — Combination squares: precision ground, etched graduations and figures, with and without level and scriber. Also: rules; micrometers; thickness gauges; calipers and dividers; screw pitch, depth, center and surface gauges; squares, sets; and bevel protractors.

BRACES AND AUGER BITS — Finest line of braces made: standard, ratchet, corner, whimble, angular, auger handles. All kinds and sizes of auger bits: solid center, single twist, expansive, electrician's, ship; car bits, gimlets, countersinks, etc.

Questions and Answers

HISTORY OF PRINTING

1091. Q.: Please let me know what INDUSTRIAL ARTS AND VOCATIONAL EDUCATION magazines offer on: (1) Early printing in the United States; (2) Printing as part of the course of instruction in our school system; (3) History of printing as a school subject. — *H. W. B.*

A.: May I give you the following references to articles which appeared in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION:

1927 — May — p. 178: "School Printing in the United States."
1927 — June — p. 214: "School Printing in the United States."
1927 — Aug. — p. 293: "School Printing in the United States."
1927 — Sept. — p. 334: "School Printing in the United States."
1936 — Sept. — p. 264: "Printing Education in America."
1936 — Oct. — p. 301: "Printing Education in America."
1938 — Sept. — p. 276: "The Evolution of Printing," Glenn U. Cleeton.
1940 — Dec. — p. 403: "Five Hundred Years of Printing."

— *J. J. M.*

VOCATIONAL GUIDANCE

1092. Q.: I am wondering whether your office has a list of articles for several years back on guidance for the various trades or anything applicable to technical or vocational training. I am presiding at a section of some one hundred high school students in a career conference soon. Our section is on "Industrial Arts, Vocational Education and Technical Training."

A.: The following list includes articles on guidance published in INDUSTRIAL ARTS AND VOCATIONAL EDUCATION during the past five years:

Guidance — 1937

Guidance and Industrial Arts, Louis F. Barocci, Mar., p. 45A.
Guidance: Educational and Vocational, Edward F. Fitzpatrick, Apr., p. 118.
Guidance Opportunities, H. W. Teichroew, Feb., p. 42.
Guidance — the Shop Teacher's Responsibility, Claude F. Turner, Sept., p. 269.
Industrial Arts, Household Arts, and Occupational Information, I. M. Fenn, Nov., p. 373.
Minnesota's Contribution to Guidance, William W. Wills, May, p. 145.
Printers Define Apprentice Qualifications, R. Randolph Karch, Dec., p. 408.
Sources of Occupational Information, L. N. Recktenwald, Aug., p. 239.
Vocational and Educational Guidance Opportunities Inherent in Industrial Arts, Louis F. Barocci, Nov., p. 371.
Vocational Guidance, R. Randolph Karch, Feb., p. 37.
Vocational Guidance with Adults, John T. Shuman, Dec., p. 404.

Guidance — 1938

I Want to Be a Printer, Harold H. Kirk, Feb., p. 52.
If You Are Considering Publishing or Printing, R. Randolph Karch, June, p. 252.
In Again — Out Again, Hyman Goldstein, Oct., p. 318.
Obtaining Occupational Information, Clifford K. Lush, Sept., p. 278.
Today's Shifters, Tomorrow's Shirkers, Hyman Goldstein, Jan., p. 14.

Guidance — 1939

Does Guidance Concern Teacher Education?, Lawrence F. Ashley, Dec., p. 396.
Getting Jobs on Graduation, L. A. Barrett, May, p. 210.
If You Bristle While You Work, Hyman Goldstein, Feb., p. 50.
Personality Guidance and the School Shop, Ray O. Mertes and L. Henry Noble, June, p. 221.
Recording Forms, Tom L. Anderson, Apr., p. 168.
Truth About the Diesel Engine, Max H. Schachner, May, p. 179.
Vocational Interests of Junior-High-School Boys, Harry G. Eberhardt, Dec., p. 403.
Vocational Opportunities in Aviation, John Rogers, Sept., p. 281.

Guidance — 1940

Follow-up, R. A. Hinderman, Oct., p. 312.
How to Get a Job in Printing, R. Randolph Karch, Sept., p. 272.
Publishing and Printing, R. Randolph Karch, Mar., p. 124; Apr., p. 155; May, p. 187; June, p. 221.
What About This Thing Called Guidance?, J. I. Sowers, Sept., p. 274.
What About This Thing Called Guidance! — An Answer, Curtis G. Gentry, Dec., p. 405.

Guidance — 1941

Counseling Procedures of Industrial-Arts Teachers, Louis V. Newkirk, Nov., p. 369.
Meeting Vocational Needs in an Institution, J. E. Balmer, June, 230.
Proposed Vocational Guidance Program, W. J. Dunning, Mar., p. 136.
Vocational Guidance of the Underprivileged, Hyman Goldstein, Feb., p. 45.

— *J. J. M.*

FINISHING CHERRY

1094. Q.: I am in need of information on the finishing and staining of cherry wood; also would like to know what stains to use. — *J. D. K.*

(Continued on page 50A)

SHELDON BBU-1242 WQ

Precision Lathe

This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collect capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate through a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways — 2 V-ways and 2 flat ways.

If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

NEW AND IMPROVED LATHE MANUAL

This manual teaches beginners the proper care and operation of a lathe. Explains the grinding of cutters, modern lathe tools, how they set-up; methods of holding work and the performance of the basic lathe operations. 50c. Discount for schools and other quantity buyers.

SHELDON MACHINE CO., INC.

4244 N. KNOX AVENUE CHICAGO, U. S. A.

DELTA Books
for the School Shops of Today

A Valuable School Shop Layout Book FREE!

Prepared by vocational instructors from all over the country—the shop layouts and photographs contained in this new book are authentic school shop installations embodying the most ingenious solutions of the problems of space, safety, lighting, convenience and teaching efficiency in both small and large schools. There are actual floor plans and photographs of 30 shops in this attractive 44 page book. Fill out form on opposite page and FREE copy will be mailed to you.

Practical Shop Bulletins FREE!

They serve as a valuable aid to the shop instructor by making available to him the same vitally important information that goes to shop executives out in the field; by keeping him in touch with actual operating conditions of the machines his students will use in actual industrial work and by enabling him to tie in with the war production program. If you wish to receive "Tooling Tips" regularly, just fill out the order form on the opposite page. There is no subscription charge, no obligation of any sort.

New Project Material

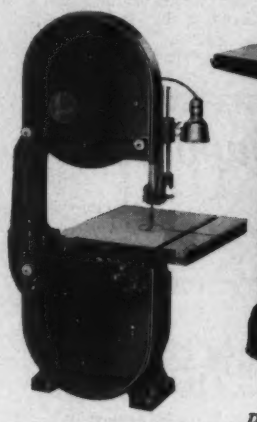
Delta here makes available for the school shop a rich source of fresh project material, prepared by practical shop men. Each item is shop tested. There are: 1. *The Deltagram*—issued 6 times yearly during the school year—each issue carries a wide range of projects from unique novelties and one-session items to more elaborate projects. Adequate working drawings and photographs feature each page plus useful shop hints. . . Subscription, 50c per year. 2. 9 new Project Books, selected projects from back issues of the Deltagram, including 21 Lovely Lamps (10c), 19 Charming Chairs (15c), One Evening Projects (10c), Garden Furniture & Novelties (10c). Toys, Games, Playground Equipment (10c), Furniture Designs (25c), Novelties (25c), 40 Fine Tables (25c), Small Furniture Designs (20c), Delta Project Books Nos. 3, 4, 5, 6, 7, 8, 9 . . . . 10c each.

Practical Operating Manuals

These books, although nominally priced, contain a wealth of valuable information with over 200 photographs, working drawings and explanatory diagrams in each volume. They cover every phase of operation and maintenance of all major tools—as well as other subjects of interest to instructors in industrial training. The material is so complete, so accurate and authoritative that some of it is being used unchanged, in the latest standard text books. All books in this series are paper covered of uniform size (6" x 9") and contain 48 pages. This series includes: Circular Saw and Jointer (25c), Lathe (25c), Band Saw and Scroll Saw (25c), Drill Press (25c), Abrasive Tools (25c), Shaper (25c), Practical Finishing, 64 pages, covering every phase of finishing (50c).

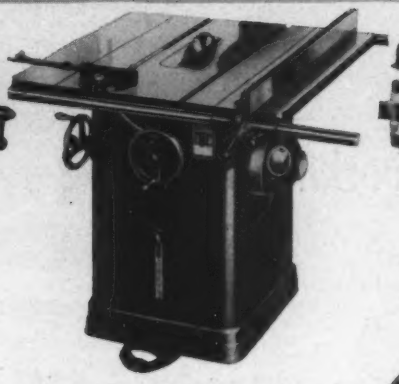
DELTA Machines

for the School Shops of Tomorrow

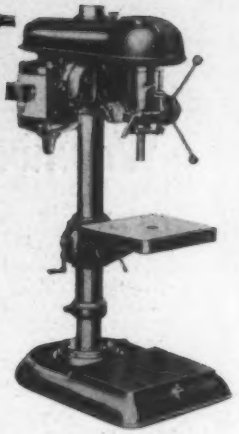


Delta 14" Band Saw—sealed-for-life ball bearings, tilting table. In both wood and metal - cutting models.

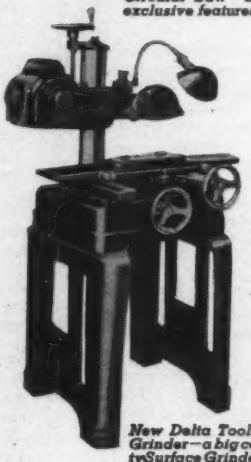
Delta 6" Jointer Unit—a compact, well guarded unit with dual control handle, patented fence and other special features.



Delta 10" Tilting Arbor Circular Saw—has many exclusive features.



Delta 17" Drill Press—has numerous special features. A full line of 11" and 14" models also available.



New Delta Toolmaker Grinder—a big capacity Surface Grinder with many unique features, at a remarkably low price.

Delta 12" Lathe—equipped with sealed-for-life bearings, self-indexing headstock—ideal for school shops.

Far-sighted school shop men have long anticipated the important changes that have taken place in the types of machines used in American industrial shops. They know that the trend toward the increased use of low-cost, high quality compact machines in all branches of U. S. industry has assumed the proportions of an industrial revolution.

They know that when the inevitable reversion to "reconstruction production" arrives — the many advantages of these machines—their low cost, flexibility, portability, low maintenance costs—will assure them a permanent place in our industrial economy.

Above all they know these developments will have a deep influence on the equipment used in the school shops of tomorrow.

USE THIS CONVENIENT ORDER FORM →

THE DELTA MANUFACTURING CO.
660-C E. Vienna Avenue
Milwaukee, Wisconsin

DELTA
MILWAUKEE

The DELTA Manufacturing Company
660-C E. Vienna Ave., Milwaukee, Wis.

(Check proper squares)

☐ Please send me FREE copy of "How to Plan a School Workshop".

☐ Please place my name on mailing list to receive FREE copies of "Tooling Tips" as issued.

☐ Please send latest Delta Catalog.

Gentlemen:

☐ I enclose 50c for one year's subscription (6 issues) of the DELTAGRAM.

☐ I enclose $_____ for which send me postpaid the Delta Project material and Operating Manuals listed below:

Quantity	Book	Amount

Name _____

Address _____

City _____ State _____

Detroit Public Library

(Continued from page 47A)

A.: The matter of finishing cherry is one which has attracted the attention of a very considerable list of users.

Cherry is peculiarly susceptible to a lightening of the color effect when finished in the clear only, and without recourse to staining. This I consider a defect in finishing practice and can be avoided by the use of a suitable water soluble stain. Sponge the completed cabinetwork with clean hot water and rag or brush to raise dents and other defects of this type. Let dry overnight, sand clean and smooth with not less than 4/0 garnet finishing paper, preferably open-coated stock. Inspect for any evidence of cross sanding and remove such scratches carefully.

Stain with a light color water solution carrying not more than two ounces of dry stain per gallon of hot, but not boiling water. This final color should be more brown than red in the relation of one red to three brown, carry a slight orange-yellow undertone, and should entirely avoid scarlet or pink tones. Only in this way can spotting be avoided and new work properly matched up to old. Old-time finishers used to make up a saturated solution of lime water by adding lump lime to a gallon of water and letting the lime slack overnight, when the clear top liquid would be used to tone both cherry and mahogany a real red. Subsequent treatment with linseed oil and waxes would further reduce this color to a warm brown over the years. The stain should duplicate this effect immediately and not copy the fiery reds produced by the lime water.

The stains mentioned in my book are those of the Pylam Products Co., Inc., 799 Greenwich St., New York, N. Y.

The penetrating wood finish mentioned is that of DuPont and sold under that trade name. This is my final choice of the many brands tried out under all conditions. Simply follow directions on the can, or better still, follow the modified outline as specified in my book since I have found that this produces an even better finish than the can directions.

A very practical modification of the final rub is to use a folded pad of 2/0 steel wool to enclose a wad of hard floor wax so that the final rubbing and waxing occur simultaneously. Let harden fifteen minutes, then brush, rag, or rotary head polish as desired. This treatment with the penetrating wood finish, two or three coats, and final wax rub gives a beautiful and very durable finish on cherry, maple, and birch, since these woods demand a thin but tough finish that is primarily a part of the wood itself. — *Ralph Waring.*

Woodworking Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BENCH
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It may be well to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

BLACKBOARD — permanent or portable

BOOKCASE

BULLETIN BOARD

CABINETS — wood or metal for filing class records, instruction sheets, drawings, finishing materials, hardware, small tools, supplies, etc.

CHAIRS — teacher's and tablet arm

CORE OVEN — for patternmaking class

DESK — teacher's, with drawer compartments

FURNACE — for melting soft metals (for patternmaking class)

GLUEPOT — 1 qt. or 2 qt., electric, gas, or steam heat

GLUE WARMER OR COOKER — 1- to 5-gal. capacity

GRINDER
- *a*) Automatic knife, direct-motor-type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

JOINTER
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbetting. Safety-cylinder type, equipped with safety guard
- *b*) 12, 16, or 18 in. direct motor drive, ball bearing. Cylinder to be of safety-head type. Table to be fitted for rabbetting. Jointer to be equipped with safety guard

LATHES
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24, 36, 48, 60, or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

MORTISER
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

PLANER — 12, 18, 20, 24, or 30-in., motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

SANDER
- *a*) Belt, direct motor drive
- *b*) Disk, motor or belt driven
- *c*) Oscillating spindle, motor driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical spindle and disk sander

SAWS
- *a*) Band saw, 20 to 36 in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cutoff, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct motor or belt driven
- *f*) Portable band saw, 14 to 20 in. ball bearing, motor driven
- *g*) Saw bench, directly connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 to 16 in., motor driven
- *j*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly. The saw is to be equipped with ripping fence and miter cutoff gauges

SHAPER
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

TENONER — single end, with coping heads and cutoff saw

VISES — rapid-acting or solid-nut type woodworking-bench vises, 7 to 10 in.

WOOD TRIMMERS — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

AWLS — brad, assorted sizes

BEVELS
- *a*) Protractor
- *b*) Sliding T, 8 in.

BITS
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet type, 8-, 10-, 12-, or 14-in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅞ in. to 1½ in.
- *g*) Expansive, ⅞ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

BLOWTORCH

BROOMS

BRUSHES
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

BURNISHERS — oval or round

CAN OPENER

CARVING TOOLS
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

CHISELS
- *a*) Cold, machinists', ⅛ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c*) Socket firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.

(Continued on page 52A)

Training for War Production Requires GOOD TOOLS

Write for Catalog No. 34 showing STANLEY TOOLS for your School Shops

FOR WOODWORKING AND FARM SHOPS
The most complete line offered by one manufacturer.

FOR ELECTRICAL SHOPS
Hammers, Bit Braces, Bit Extension, Screw Drivers, etc.

FOR SHEET METAL SHOPS
Hammers, Chisels, Punches, etc.

FOR AUTOMOBILE SHOPS
Body and Fender Tools, Hammers, Chisels, Punches, Screw Drivers, etc.

FOR MACHINE SHOPS
Hammers, Rules, Chisels, Punches, Levels, etc.

FOR FORGE SHOPS
Anvil Tools, Tongs, Hammers, etc.

Visual Teaching Aids and Project Plans available at cost.

STANLEY TOOLS

DIVISION OF THE STANLEY WORKS
Educational Dept., New Britain, Conn.

1843 STANLEY 1943
TRADE MARK

No. 41 "YANKEE" AUTOMATIC DRILL

No. 30A "YANKEE" SPIRAL RATCHET SCREW DRIVER

No. 10 "YANKEE" RATCHET SCREW DRIVER

No. 15 "YANKEE" RATCHET SCREW DRIVER

No. 2150 "YANKEE" BIT EXTENSION

No. 1545 "YANKEE" RATCHET HAND DRILL

No. 2101 "YANKEE" RATCHET BRACE

No. 900 "YANKEE" VISE

No. 1993 "YANKEE" VISE

JUST as "Yankee" Fine Mechanics' Tools meet and match the need for speed in the hands of skilled workmen on the war-production front, so do they meet the needs of those who teach and train the skilled workmen of the future. Students learn faster with "Yankee" Tools — learn, too, to work more accurately. And when you equip with these pretested, time-and-trouble-savers, you enlist more than a half century of proved performance, built-in quality, and prestige. . . . Grow up with "Yankee" Fine Mechanics' Tools — the tools that grown-ups depend upon.

The "Yankee" Tools illustrated above are just a few of those pictured and described in "Yankee" Tool Book V-3. Write for a copy today.

"YANKEE" TOOLS
make good mechanics better
North Bros. Mfg. Co., Phila., Pa., U. S. A.
Established 1880

(Continued from page 50A)

- *d*) Socket firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e*) Tanged firmer, bevel edge, ⅛, ¼, ½, ¾, 1, and 1¼ in.

CLAMPS
- *a*) Bar, 24, 36, 48, and 60 in.
- *b*) Hand-screw, 4, 5, 6, 7, 8, 10, 12, and 14 in.
- *c*) Malleable-iron C, 4, 6, and 8 in.

DIVIDERS — wing, 6 in. and 10 in.
DOWEL PLATE — 6 in. long
DOWELING JIGS — with bushings
DRAWKNIVES — 7 in.
DRILL
- *a*) Automatic hand, with 8 drill points
- *b*) Chuck, 0 to ⅜ in.
- *c*) Hand, 0 to ⅜ in., for round-shank drills
- *d*) Star, for concrete, ½ in. and ¾ in.

FILES
- *a*) Auger bit, assorted, 6 in.
- *b*) Cabinet, 8 in. and 10 in.
- *c*) Card and brush
- *d*) Flat, wood, 10 in.
- *e*) Mill, bastard cut, 12 in.
- *f*) Round, bastard cut, 12 in.
- *g*) Taper, slim, 5½ in. and 7 in.

FIRST-AID CABINET AND SUPPLIES
GAUGES
- *a*) Bit, adjustable
- *b*) Jointer
- *c*) Marking, metal or hardwood
- *d*) Mortise, metal or hardwood
- *e*) Panel

GLASS CUTTER
GOUGES
- *a*) Tanged firmer, outside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
- *b*) Tanged firmer, inside ground, handled, ⅛, ¼, ½, ¾, and 1 in.
- *c*) Spoon, ½, ¾, and 1 in.

HAMMERS — claw, bell faced, 10, 12, 13, and 16-oz.
HATCHET — bench, 4-in. cut
JARS — earthenware, 1-qt. capacity
KNIVES
- *a*) Jointer, to fit power machine
- *b*) Planer, to fit power machine
- *c*) Sloyd, 3-in. blade

LEVELS
- *a*) Wood, 24 in.
- *b*) Machinists', 12 in.

MALLETS — hickory, 3 by 5 in. head
NAIL SETS — 1/16 in. and 3/32 in. points
OILERS — bench, 1/3 pt., coppered, best grade
OILSTONES
- *a*) 1 by 2 by 8 in. in iron box
- *b*) Gouge slip, medium, 4½ by 2⅛ by ⅝ by 5/16 in.
- *c*) Gouge slip, fine, 3 by 2 by ⅜ by ⅛ in.

PINCERS — 6 in. carpenters'
PINCH DOGS — ¾, 1, and 1¼ in.
PLANES
- *a*) Block, adjustable, 6 in. long, 1⅝-in. cutter
- *b*) Circular
- *c*) Combination, adjustable
- *d*) Core box
- *e*) Duplex, fillister and rabbet
- *f*) Fore, ⅛ in., 2⅜-in. cutter
- *g*) Irons, double
- *h*) Jack, 14 in., 2-in. cutter
- *j*) Jointer, 24 in.
- *k*) Round, wood, 1¾ in.
- *l*) Router
- *m*) Smooth, 9 in., 1¾ in. or 2-in. cutter

PLIERS
- *a*) Roundnose, 5 in.
- *b*) Side-cutting, 6 in.

PUTTY KNIVES
RASPS — half round, wood, 10 in.
RULES
- *a*) Board
- *b*) 1 ft. or 2 ft. graduated by 8ths and 16ths
- *c*) Shrink, ⅛ in., 3/16 in.

SAWS
- *a*) Back, 12 in., 14 point
- *b*) Band, to fit power machine
- *c*) Compass, 10 in.
- *d*) Coping, frames
- *e*) Coping, blades
- *f*) Crosscut, 9 tooth, 22 in. long
- *g*) Crosscut, circular for power machine
- *h*) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
- *j*) Hack, frames, 10 in. or adjustable
- *k*) Hack, blades, 10 in.
- *l*) Keyhole, 10 in., 10 point
- *m*) Rip, 7 point, 22 in. long
- *n*) Rip, circular for power machine
- *o*) Set, 10 points per inch and finer
- *p*) Set, 10 points per inch and coarser
- *q*) Turning frame, 14 in.
- *r*) Turning blades, 3/16 by 12 in., 10 tooth
- *s*) Miter box, 24 by 4 in. saw, 7-in. capacity at miter

SCRAPERS
- *a*) Cabinet
- *b*) Glue, triangular
- *c*) Veneer, blade, 2¾ in. long, handle 11 in. long

SCREW DRIVERS
- *a*) Cabinetmakers', 4, 6, and 8 in.
- *b*) Quick return, spiral ratchet

SHOOT BOARD — and plane
SNIPS — tinners', forged steel, 2½-in. cut
SPOKESHAVES — adjustable, raised handle, 10 in. long
SQUARES
- *a*) Combination, 12 in.
- *b*) Try-, iron handle, 8 in.
- *c*) Framing, 2 ft.

STEEL FIGURES — hand cut, ⅛ in.
TAPELINE — 50 ft., steel
TRAMMEL POINTS — adjustable metal frame, steel points
TURNING TOOLS
- *a*) Calipers, 6 in. inside and outside
- *b*) Calipers, 12 in. inside and outside
- *c*) Parting tools, ⅛ in.
- *d*) Round point, ¼ in., ½ in., ¾ in.
- *e*) Spear point, ¼ in., ½ in., ¾ in.
- *f*) Square point, ¼ in., ½ in., ¾ in.
- *g*) Turning chisels, ¼ in., ½ in., ¾ in.
- *h*) Turning gouges, ¼ in., ½ in., ¾ in.
- *j*) Turning skews, L.H., ¼ in., ½ in., ¾ in.
- *k*) Turning skews, R.H., ¼ in., ½ in.

VISE — 3-in. jaw, anvil face
WRENCHES
- *a*) Adjustable, 8, 10, and 12 in.
- *b*) Headless setscrew
- *c*) Pipe, 10 in. and 12 in.
- *d*) S type or open-end type to fit ⅛-in. to 1-in. N.C. nuts

(Continued on page 54A)

CARTER TOOLS *add New Interest to Woodworking Courses*

CARTER C-51 Bench Shaper

Here is a tool used to make all kinds of molding cuts, chamfers, beads, and other finishing cuts. It will help students learn to finish their work efficiently and effectively.

The C51 Shaper has the exclusive Tilting Spindle. The patented motor holder can be tilted from vertical to any angle up to 45°. Cutter costs are reduced – time spent in grinding, matching, balancing blades is eliminated.

The machined steel table top measures 16" x 26", ample space for all average size shaping work. Complete details in Catalog No. 77. Write for a copy today.

1 H. P. MOTOR – 18,000 R. P. M.

500 Distinctive Contour Cuts with 3 Carter Cutters

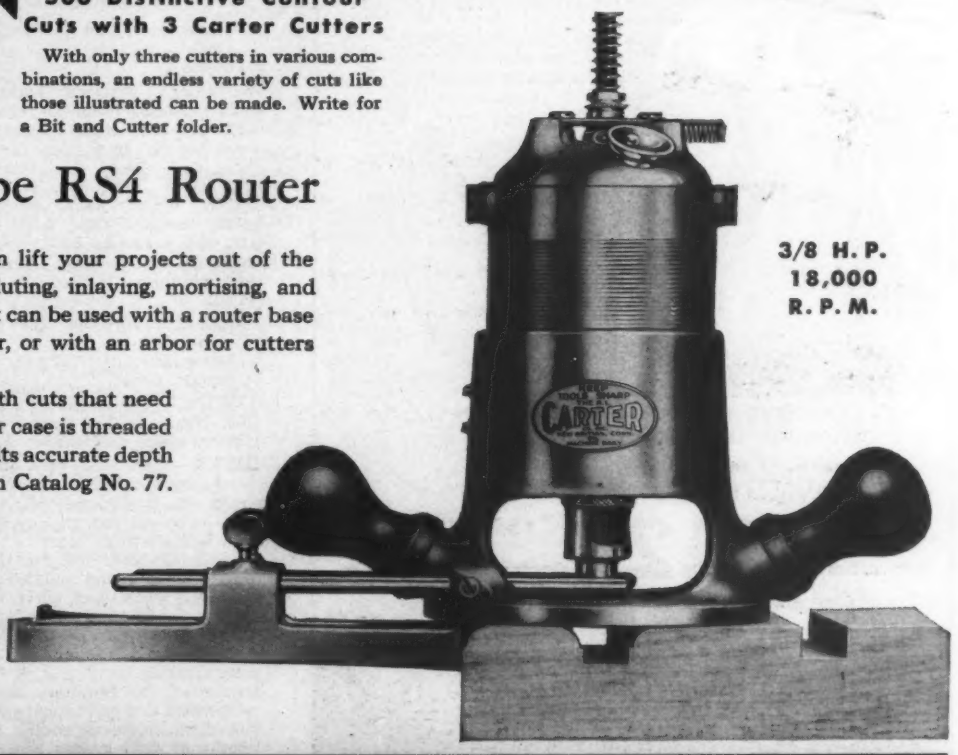
With only three cutters in various combinations, an endless variety of cuts like those illustrated can be made. Write for a Bit and Cutter folder.

CARTER Type RS4 Router

This multi-purpose tool can lift your projects out of the "rut" with veining, beading, fluting, inlaying, mortising, and many other interesting cuts. It can be used with a router base and chuck for bits as a router, or with an arbor for cutters as a hand shaper.

Its high speed assures smooth cuts that need no further finishing. The motor case is threaded to fit the Router base and permits accurate depth adjustments. Also described in Catalog No. 77.

3/8 H. P. 18,000 R. P. M.



Used as a shaper with Compound Curve Guide

CARTER TOOLS

R. L. CARTER DIVISION
THE STANLEY WORKS
112 ELM STREET, NEW BRITAIN, CONNECTICUT

SPEED UP

Defense Training

with VICTORAY Prints

It is logical and sound instruction for schools to use blue print equipment in their training work. Industrial shop activities are based on blue prints.

ONLY 3 MINUTES
AFTER TRACINGS ARE FINISHED
PERFECT BLUE PRINTS
OR BLACK AND WHITE PRINTS ARE AVAILABLE

WITH VICTORAY YOUR COST OF PRINTS WILL BE

APPROXIMATELY 1c PER SQUARE FOOT

Safety VICTORAY Simplicity

No Motor — Silent Operation — No Odor. Makes perfect prints in day light. Can be operated safely by any novice. Portable — Takes little space.

Prints 24" x 36" or several smaller sheets in one operation in 3 minutes.

VICTORAY Economy

Minimum Life of Lamps 1200 Hours.
Give 1200 hours of printing service.
Lamps obtainable at
20c each everywhere.

Replacement Set of 8 Lamps $1.60

NO EXPENSIVE TRANSFORMERS, PHOTO FLOOD, MERCURY OR ARC LAMPS TO FUSS WITH

A Professional Fast Printer At Lowest Maintenance Cost

IMMEDIATE DELIVERIES TO SCHOOLS

NET PRICE INCL. LAMPS WITH ACCESSORIES $127.50 F. O. B. FACTORY BATTLE CREEK, MICH.

SAMPLE SUPPLY OF PAPER AND DEVELOPER INCLUDED

Write us today for descriptive literature

VICTORAY CORPORATION

GENERAL OFFICES AND PLANT

BATTLE CREEK • MICHIGAN

A FEW VALUABLE SALES FRANCHISES ARE STILL AVAILABLE TO JOBBERS

Woodworking—Materials and Supplies

ALCOHOL

BENZINE

BRADS — 3/8 in., 1/2 in., and 5/8 in. No. 20; 3/4 in. and 7/8 in. No. 19; 1 in. No. 18; 1 1/4 in. and 1 1/2 in. No. 16; 1 3/4 in. No. 15; 2 in. and 2 1/2 in. No. 14

CARBON PAPER — black

COLORS — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Vandyke brown, and vermilion

COLORS — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Vandyke brown, and vermilion

DECALCOMANIA TRANSFERS

DOWEL PINS AND PLATES

DOWELS: hardwood, 3-ft. lengths, 1/4 in., 5/16 in., 3/8 in., 1/2 in., 3/4 in.

ENAMEL
- *a*) Selected colors
- *b*) Undercoater

FILLERS — paste: natural, golden oak, dark oak, and mahogany

FILLETS — leather, 1/4 in. and 1/2 in.

GLUE
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

HARDWARE: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports

HOOKS
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

LACQUER — black, clear, cobalt blue, ivory, medium green, red, thinner, white, and yellow

LUMBER — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine

In ordering pine, mill run, kiln dried will be found suitable for carpentry, while short, select, kiln dried, 4 in. and wider or No. 1 shop common, kiln dried will be required for cabinetmaking and patternmaking

Hardwood, for furniture, should be specified first and second grade, kiln dried, standard widths and lengths, or short lengths

MOLDINGS

NAILS
- *a*) Common, 6d, 8d, and 10d
- *b*) Flathead, 1/2 in. No. 20, 3/4 in. No. 19, 1 in. No. 18, 1 1/4 in. and 1 1/2 in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

OIL
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

OVERLAY CARVINGS

PANEL OR PLYWOOD — 3 ply, 5 ply, and 7 ply

PATTERN LETTERS

PINS — escutcheon

PUMICE STONE — No. 0

RAPPING PLATES

ROTTENSTONE

SANDPAPER — Garnet cabinet paper, 3/0, 2/0, 0, 1/2, 1

Garnet finishing paper, 6/0, 4/0

Garnet paper can also be obtained in rolls of 50 yd. in widths 4 in. up to 48 in. Narrower widths on special order

SCREW EYES

SCREWS
- *a*) Flathead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 5 by 5/8 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in.
- *b*) Flathead, bright, No. 3 by 1/2 in., No. 4 by 1/2 in., No. 6 by 3/4 in., No. 7 by 7 1/2 in., No. 8 by 1 in., No. 10 by 1 in., No. 8 by 1 1/4 in., No. 10 by 1 1/4 in., No. 14 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in., No. 10 by 1 3/4 in., No. 12 by 1 3/4 in., No. 10 by 2 in., No. 12 by 2 in., No. 14 by 2 in., No. 12 by 2 1/4 in., No. 14 by 2 1/4 in., No. 14 by 2 1/2 in.
- *c*) Oval head, brass, No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., and No. 10 by 1 1/4 in.
- *d*) Roundhead, blued, No. 3 by 3/8 in., No. 3 by 1/2 in., No. 5 by 3/4 in., No. 6 by 3/4 in., No. 7 by 7/8 in., No. 8 by 1 in., No. 10 by 1 1/4 in., No. 10 by 1 1/2 in., No. 12 by 1 1/2 in.
- *e*) Roundhead, brass, No. 3 by 3/8 in., No. 4 by 1/2 in., No. 4 by 5/8 in., No. 5 by 3/4 in.

SHELLAC
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

NOTE: Shellac should be kept in glass or earthenware containers

STAINS — oil, spirit or water. Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut

STEEL WOOL — No. 0 and No. 2/0

TURPENTINE

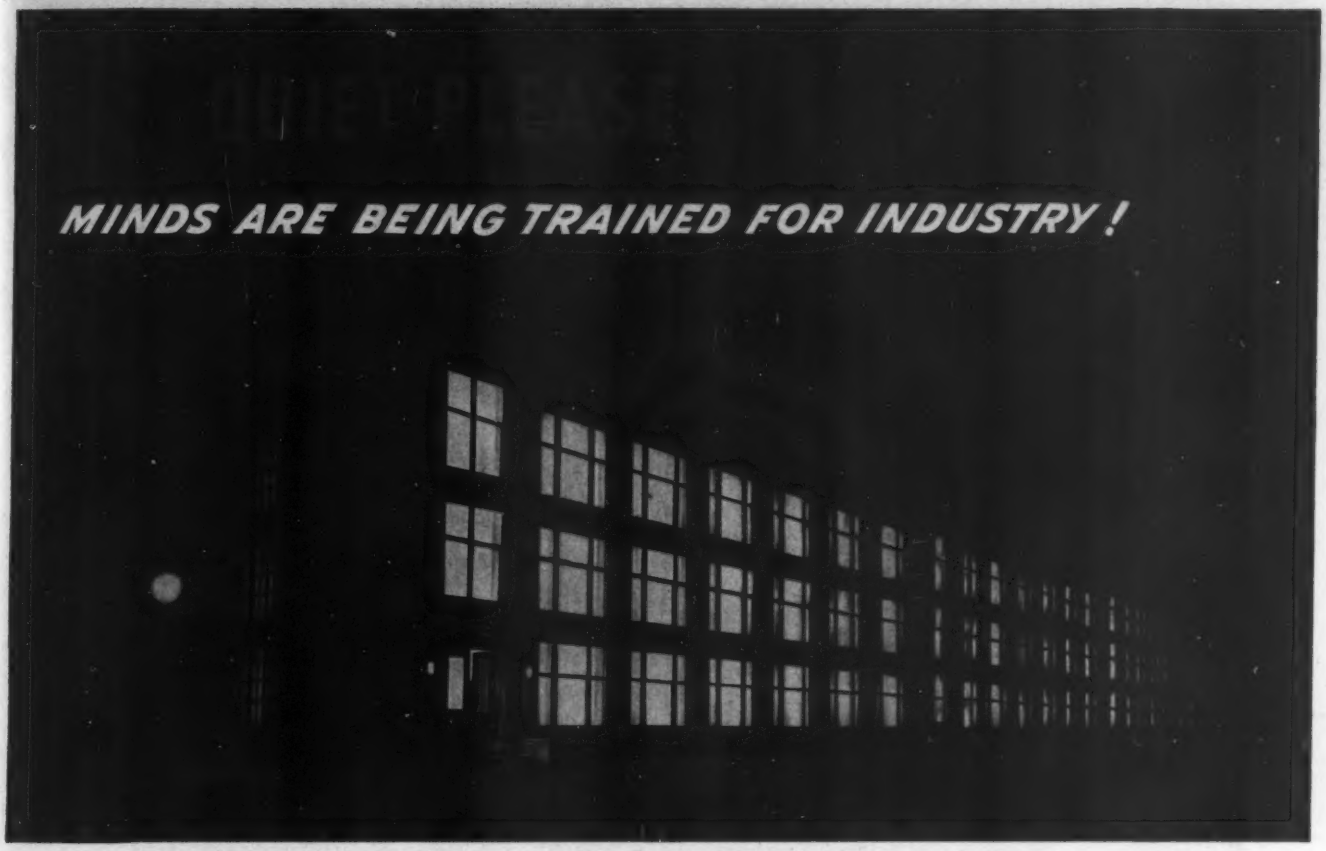
TWINE

VARNISH — coach, flat, remover, spar, and rubbing

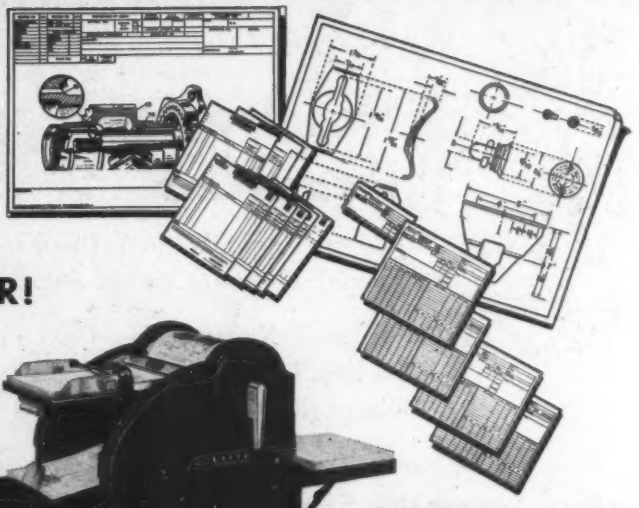
WASTE — cotton, white

WAX — bees and finishing

WHITE LEAD



Today, the training of minds and hands is on a production line schedule. "Speed and Accuracy" is the war cry of industry in the drive for a quicker Victory! DITTO matches the tempo of this keynote. DITTO is *fast.* DITTO is *error-proof.* For these reasons, America's mightiest industries are using DITTO. For these same reasons—*and because DITTO is versatile*—you will find distinct advantages offered by DITTO to your essential industry of producing trained minds and skilled hands.



DITTO HELPS TRAIN MINDS FASTER!

From the *single original,* DITTO makes copies of anything written, printed or drawn—one to eight colors at once—at a quick, easy turn of the handle. No stencil, type, ink or carbon. To try DITTO is to find it invaluable for teaching.

Let students themselves use DITTO. They learn an operation important today in business routine.

Write for free samples of new teaching ideas. They will show you how to make even greater contributions to the war effort.

DITTO

Trade Mark Reg. U. S. Pat. Off.

DITTO, Inc., 2219 W. HARRISON ST., CHICAGO, ILL.

SPEED UP!

Get copies of Idea Material . . . Forms . . . Outlines . . . Drawings . . . Specifications

IN MINUTES, NOT DAYS!

● A limited number of Ditto gelatin machines—the R5 Rotary, the Portable and the Filmograph—are available without priorities while our present stock lasts. Better get your Ditto duplicator now!

"MODEL-DIP"

A SEALACELL PRODUCT

A FLAT BLACK FINISH FOR MODEL AIRCRAFT

Quick-Drying *Economical*

Simply immerse models for a moment in Model Dip and allow to drain.
A rapid, simple, effective method of finishing. May be applied with a brush if desired.

AVAILABLE IN QUARTS OR GALLONS

Let Us Supply Your Requirements For The War Models You Are Making.
Will speed completion of your Army and Navy allotment.
Our Products Meet the Specification of the Armed Services.

SEALACELL PRODUCTS

Penetrating Water Repellent Wood Finish For
SCHOOL PROJECTS — FURNITURE — CABINETS — WOODWORK.

No Brushes Required — APPROXIMATE COST 1¢ PER SQUARE FOOT — **No Rubbing Between Coats**

Apply With A Cloth — Dustproof on Application.
No Special Finishing Room Required. All Sanding Done On Raw Wood.

Sealacell Never Raises the Grain of the Wood.
Sealacell Can Be Applied In the Natural.
Sealacell Can Be Mixed With Ground in Oil Colors For Staining.

Send For Demonstration Kit—Enough Material to Finish Approximately 100 Square Feet of Surface.
Prove to Your Own Satisfaction the Effectiveness of our Method. Price of Complete Kit . . . . $1.00.

Sealacell Finishes Resistant to Alcohol, Cosmetics and Hot Dishes.

Send For Folder "Facts". A Post Card Will Bring It.

GENERAL FINISHES SALES AND SERVICE COMPANY

Division W. H. Pipkorn Co.

Pioneers in Development and Service

1548 West Bruce Street Milwaukee, Wisconsin

ATKINS *Training Tells*

● Unable, under wartime conditions, to give new workers the customary "breaking in" period on valuable tools and equipment, industry depends more than ever before on the manual training teacher. This places an extra responsibility on the teacher—solved in part by training pupils on industry-accepted tools like Atkins Saws. Correctly designed, finely made, and quality throughout, training on Atkins Saws will stand your students in good stead when they switch from school to shop. When requisitioning saws, remember—"Atkins Training Tells!"

Send for FREE Wall Chart Illustrating Saw Fitting

E. C. ATKINS AND COMPANY 404 S. Illinois St., Indianapolis, Indiana

ASSOCIATION NEWS

(Continued from page 44A)

tions from his cadet teaching center to Oswego.

Because of the wide dispersion of members of Phi Chapter of Epsilon Pi Tau, a public-relations bureau was created to keep the organization in close contact with one another. Members of Epsilon Pi Tau, Phi Chapter, are teaching in civilian schools, schools of the armed forces, and in private technical schools. Many others are in active service with the various branches of the armed forces. This new department is doing a good job of keeping its men informed of the latest developments on the home front of education.

A new program of gainful entertainment for the student body of Oswego State Teachers College was formulated under the leadership of Alexander Rosen. This program consists of the showing and procuring of many highly valued industrial motion pictures. The first of the series was "Trees and Homes," a picture story in technicolor of the lumbering industry. The second film soon to be presented will deal with the manufacture of the famous Curtiss P–40 pursuit plane now seeing service on all fronts where the Army Air Force is in operation. Other films dealing with the manufacture of gasolines, lubricating oils, and like topics will be shown during the year. A schedule of three pictures every two months has been formulated.

Front row, left to right: Dr. Gordon O. Wilber, cosponsor; initiates Frank Campbell, Howard VerGow, Martin Petersen, and cosponsor William E. Huss. Standing, initiating team, left to right: Alexander Rosen, Hamilton King, William Gallik, David Wilson, William Limbacher, Clifford Ruth, Sherwood Van Atta, and Raymond Gilky

News Notes

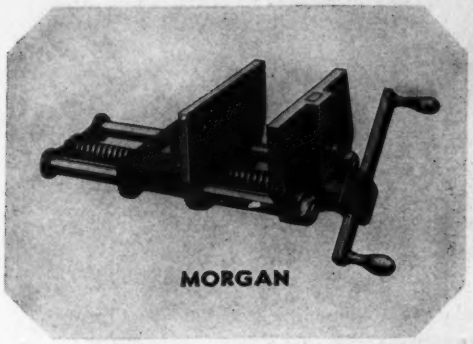
♦ The purpose of the 1943 Victory Book Campaign is to gather up outstanding good books for the men in the army, navy, coast guard, marines, and the merchant seamen. Books, army and navy men say, are important for the morale of the fighting men, as they fill their leisure hours with pleasure, relaxation, and interest.

Special service officers request that books donated be first rate in quality, and also in good physical condition.

Donate good books.

♦ College graduates with approximately five years experience with steel or steel construction are needed by the U. S. engineers in the construction of new locks at Sault Ste. Marie, Mich. The duties will consist in checking steel as it arrives, inspecting assembly of steel on job or in place, and rejecting inferior materials or workmanship. Must have experience, too, in electric welding or background for quickly learning about it. The

(Continued on page 70A)



MORGAN VISES for Practical Training

Morgan Vises represent more than a quarter of a century of experience in manufacturing vises. Made of quality materials and exacting workmanship, these vises are ready and able to give the utmost in industry and school shops for wartime service.

CONTINUOUS SCREW AND QUICK ACTION VISE

Designed and built to withstand the most severe service. The extra heavy Cold Rolled Screw and Solid Bronze Nut will last a lifetime.

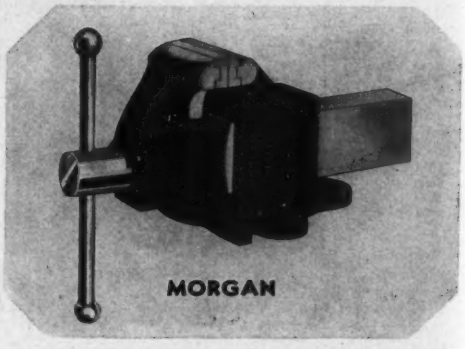
THE MORGAN VISE CO.

120 N. JEFFERSON ST. CHICAGO, ILL.

MACHINIST VISE

Unsurpassed for strength and durability. Supplied with stationary or swivel base and in various sizes.

Morgan semi-steel vises will give you years and years, of unbroken, satisfactory service. Thousands of school shops throughout the country are using Morgan vises as standard industrial-arts equipment. That is why, too, their shops are more economical and more efficient.



BUILT for Industrial and School Shop Use

Teaching Materials for Industrial Education

CHRIS H. GRONEMAN*

(*Continued from page 57 of the February, 1943, issue*)

The following list of teaching aids was collated to help the teachers of the various departments of industrial arts and vocational education.

Many of the booklets and articles contained in this list have cost those who distribute them quite an appreciable amount of money. It is but courtesy to enclose sufficient postage with your request to cover mailing charges.

It is advisable that teachers use school stationery when writing for any of the items listed. All items are free unless otherwise noted. In most cases a small charge is made when free items are ordered in quantities.

Woodworking Division

Abrasive Co., Simonds Saw & Steel Co., Philadelphia, Pa.
- *Grinding Wheel Data Book*
- *Safety Code for the Use, Care, and Protectection of Abrasive Wheels*
- *General Purpose Grinding Wheels*

Adjustable Clamp Co., 417 N. Ashland Ave., Chicago, Ill.
- *Adjustable Clamp Reference Catalog No. 16*

American Lumberman, 431 South Dearborn St., Chicago, Ill.
- *Touch Wood* — 15c

American Reedcraft Corp., 130 Beekman St., New York, N. Y.
- *Projects in Leathercraft*
- *Raffia*
- *Cane Seat Weaving*
- *Colonial Chair Frames*
- *Creative Handicraft*
- *Raffia and Reed*

American Screw Co., Providence, R. I.
- *Wood Screws*
- *Circulars on Phillips Recessed Head Screws*

American Vocational Association, Inc., 1010 Vermont Ave., Washington, D. C.
- *Standards of Attainment in Industrial Arts* — 25c
- *A Study of Industrial Teacher Education at the Graduate Level* — 30c

American Walnut Mfg. Ass'n., 616 So. Michigan Ave., Chicago, Ill.
- *The Story of American Walnut* (free to teachers)
- *Of Course It's Walnut* (free to teachers)

Appalachian Hardwood Manufacturers, Inc., 414 Walnut St., Cincinnati, Ohio
- *Appalachian Hardwood*
- *Chestnut As a Core Wood*
- *Appalachian Beech, Birch and Maple*
- *Protection Through Selection*
- *Appalachian Yellow Poplar*
- *Appalachian Hardwood Wall Paneling*

Atkins and Co., 402 S. Illinois St., Indianapolis, Ind.
- *Saw Sense*
- Demonstration Saw (loaned to schools for 8 weeks or sold at cost of $3.50 when requested on official school letterhead)

Behr-Manning Co., Troy, N. Y.
- *A Lecture Course on Coated Abrasives* (to teachers only)
- Coated Abrasives for Finishing Metal (chart) (to teachers only)
- *Supplement to the Lecture Course on Coated Abrasives* (to teachers only)
- *Industry's Woodworking Arbasive Chart* (to teachers only)
- *Sandpaper — Its How and Why* (to teachers and students)

Brodhead-Garrett Co., Cleveland, Ohio
- *Catalog of Industrial Arts Supplies and Equipment*

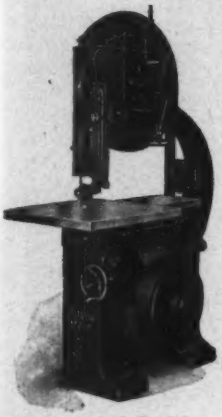
E. L. Bruce Co., Memphis, Tenn.
- *Bruce Hardwood Flooring*
- *Terminiz Pictorial*
- *Modern Floor Finishing*
- *How to Detect Termites*

California Redwood Association, 405 Montgomery St., San Francisco, Calif.
- *Lumber Letter No. 2*
- *The Physiology of Trees*
- *California Lumber Industry* (single copy free; 10c each in quantities)

(Continued on page 60A)

*Industrial Education Department, A. & M. College of Texas, College Station, Tex.

proved by performance



No. 217 30-inch Band Saw

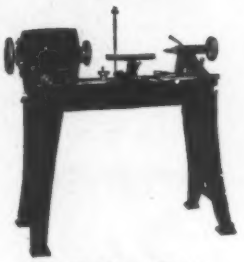
No. 535
Oilstone Tool Grinder

The "Oliver" Machinery Company in its many years of service to the school shop has had considerable experience in the planning and equipping of the school wood shop.

Industrial Educators can be proud of "Oliver" Equipment. It possesses those qualities that it takes for long and satisfactory service.

The selection of Equipment is an indication of the calibre and ability of the man making the choice. Be sure you select machinery that reflects credit to your judgment.

No. 91
Hollow Chisel Mortiser



No. 51 4-Speed Motor Head Lathe

No. 144 6-inch Hand Planer and Jointer

Showing "Oliver" machines in woodworking shops in Mt. Pleasant and Hope Street High Schools, Providence, Rhode Island.

Oliver Woodworking Machines

Circular Saw Benches	Jointers
Cut-off Saws	Mortisers
Band Saws	Jig Saws
Band Saw Brazers	Boring Machines
Oilstone Tool Grinders	Sanders
Wood Lathes	Glue Heaters
Surface Planers	Vises
Wood Trimmers	Shapers

OLIVER

OLIVER MACHINERY COMPANY
GRAND RAPIDS, MICHIGAN

Is UNUSED CAPACITY on the job?

IT'S there, if you'll put it to work! You can release the unused capacity without extra exertion simply by using Delta files. In test after test, Delta has accomplished on the average 25% or more work than ordinary files in identical time and conditions. You can easily see why in your own tests — when you notice the curling Delta "shavings" which mean increased work. Give Delta the showdown test to speed production.

DELTA FILE WORKS
Philadelphia, Pa.

DELTA FILES

(Continued from page 58A)

The Carborundum Co., Niagara Falls, N. Y.
- *Romance of Carborundum*
- *Short Cuts to Better Work* (free to teachers only; otherwise, 10c)
- *Abrasives in the Service of Industry*
- *Colored Wall Chart* (free to teachers)

Casein Co. of America, Inc., 350 Madison Ave., New York, N. Y.
- *Casco Gluing Guide*
- *Cascamite Projects Folder* (Water Sports Equipment)
- Samples of Casco Glue
- Casco Projects (furniture)
- *How to Make Veneered Panels* — 50c

Caterpillar Tractor Co., Peoria, Ill.
- *Logging Around the World*
- *Eastern Logging*
- *One-Half Century Progress in Western Logging*

Century Furniture Co., Grand Rapids, Mich.
- *Furniture* — $1

Chicago Wheel & Mfg. Co., 1101 West Monroe St., Chicago, Ill.
- *Handee Hobbies* — 25c

Clover Mfg. Co., Norwalk, Conn.
- *Clover Catalog of Coated Abrasives and Grinding and Lapping Compound*

Albert Constantine and Son, Inc., 797 East 135th St., New York, N. Y.
- *Constantine's Master Manual for Woodworkers* — 25c
- *50 Varieties of Veneers* — $2.75

Craftsman Wood Service Co., 2727 Mary St., Chicago, Ill.
- *Hunt Catalog No. 14 for Woodworkers* — 10c

Cyco Manufacturing Co., Davenport, Iowa
- *Home Craft Furniture* — 10c

The Delta Manufacturing Co., 600 East Vienna Ave., Milwaukee, Wis.
- (See Metalworking Division)

Department of Conservation, 121 State House, Springfield, Ill.
- (Single copy of the following free to teachers and students)
- *Forest Trees of Illinois*
- *Planting Black Walnut in Illinois*
- *Elements of Forestry*
- *Forest Tree Planting Manual for Illinois*
- *Fire — Forest's Public Enemy No. 1*
- *Illinois Conservation* — Periodical, quarterly

Henry Disston & Sons, Inc., Philadelphia, Pa.
- *Wall Charts on Handsaws, Hacksaws, and Files*
- *The Saw, Tool, and File Manual*
- *The Pruning Guide*

Douglas Fir Plywood Assoc., Tacoma, Wash.
- *Portfolio of Architectural Plates*
- *Dir-Biltwith Plywood Manual*
- *Plans for Plywood Rowboats and Sailboats*
- *Construction Details for Plywood Accessories*
- *Facts for Finishing Plywoods*
- *Wall Chart of Plywoods Grades*
- *How to Use the Square*
- *Miniature Construction*
- *How to Organize a Builder's Club*

Forest Products Laboratory,[1] U. S. Department of Agriculture, Madison, Wis.
- *A-1 Storing Timber*
- *B-10 Nailing of Boxes*
- *B-11 Wood-Moisture Content*
- *B-12 Compression Wood*
- *D-5 Lumber Moisture Content*
- *D-6 Government Publications*
- *D-11 Black Ash and White Ash*
- *D-12 Warping*
- *F-2 Liquid Glues*
- *F-4 Water-Resistant Glues*
- *F-13 Wood-Moisture Content*
- *F-15 Time of Cutting Timber*
- *F-33 Green and Seasoned Timber*
- *101 Lumber from Live and Dead Trees*
- *103 Mahogany, Walnut, and Red Gum*
- *104 Animal Glues Overheated*
- *116 Birch, Beech, and Maple*
- *119 Douglas Fir and Southern Pine*
- *125 Oak Woods*
- *131 Wood Compared to Plywood*
- *134 The Crate Corner*
- *139 Sunken Joints in Furniture Panels*
- *146 Glue Stains Removed*
- *153 Virgin Growth and Second Growth*
- *162 Mahogany and Imitations*
- *170 Casein Glue*
- *171 Red Hickory and White Hickory*
- *175 Hardwood and Softwood — Drying ....*
- *180 Air Drying and Kiln Drying*
- *181 Wood-Moisture Content*
- *186 End Checks of Wood*
- *187 Hardwoods and Softwoods*
- *189 Heartwood and Sapwood*
- *193 Starved Glue Joints*
- *195 Some Books on Paints and Varnishes*
- *197 Veneered and Solid Furniture*
- *198 Douglas Fir Wood*
- *205 Defect in Lumber*
- *207 Glues for Woods*
- *209 Softwood Structure*
- *210 Hardwood Structure*
- *211 Strong and Weak Glue Joints*
- *213 Case Hardening*
- *214 Southern Yellow Pine*
- *215 White Pine Group*
- *217 Rayon and Silk — Manufacture*
- *218 Weights of Woods*
- *221 Woods-Weathering and Decay*
- *223 Factory Method of Glue Joint*
- *224 Blight-Killed Chestnut*
- *225 Blue Stain in Woods*
- *226 Glues for Archery*
- *228 Moisture-Proofing Woods*
- *229 Decay of Heartwood*
- *232 Glue Joints Chemical Treatment*
- *233 Air Drying and Kiln Drying*
- *234 Shrinkage of Wood-Longitudinal*
- *236 Nail Holding Power of Woods*
- *239 Measuring Moisture Content*
- *240 Definitions*
- *243 Nailing of Wood*
- *244 Laminated Diving Board*
- *247 Nailing Dense Hardwoods*
- *249 Paints Containing Borax*
- *R 30 Vegetable Glues*
- *R 281-2 Blood Albumin Glues*
- *R 475 Drying and Conditioning Glued Joints*
- *R 492 Animal Glues*
- *R 768 Sap or Moisture Content of Wood*
- *R 869 Gluing With Animal Glue*
- *R 914 Laying Veneers*
- *R 965 Artificial Aging of Wood for Paneling*
- *R 966 Bending Wood*

Grand Rapids Fibre Cord Co., Grand Rapids, Mich.
- *Art Fibre Furniture Weaving*

The Home Craftsman Magazine, 115 Worth St., New York, N. Y.
- *One-Evening Projects* (40 selected small projects) — 50c
- *Craftsman's Silhouette Book* (116 exclusive silhouette designs on graph squares) — 50c

Industrial Arts Cooperative Service, 519 West 121 St., New York, N. Y.
- *1942 Descriptive Catalog of Publications*
- *Catalog of Materials*
- *Industrial Arts Cooperative Service* (News Sheet)
- *First Teachers Cooperative Association in America*

Iowa State College, Ames, Iowa
- *Objectives of Industrial Arts Education* — 75c
- *Test Questions in Industrial Arts Education* — 75c
- *Poems for Teachers of Industrial Arts Education* — 75c
- *Saws, Proverbs, and Maxims* — 15c
- *Buyer's Guide* — 35c
- *Leisure Time Bibliography* — 75c
- *A Guide to Woodworking Problems* — 35c
- *A Guide to Metalworking Problems* — 30c

(Continued on page 62A)

[1]It is suggested that anyone requesting these publications from the Laboratory describe them as "technical notes," or "mimeographs," and use the number when ordering. The mimeographs in the list are identified by the "R" series of numbers.

Train Them as Experts

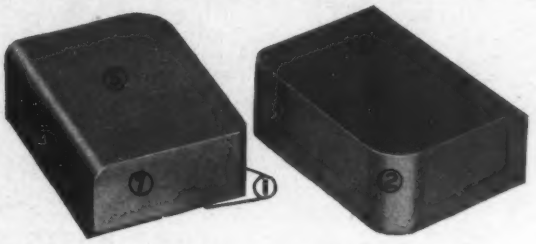
with this Newest, Simplest, Surfacing Method!

SEE WHAT

PORTER-CABLE

Wet-Belt Surfacer Will Do!

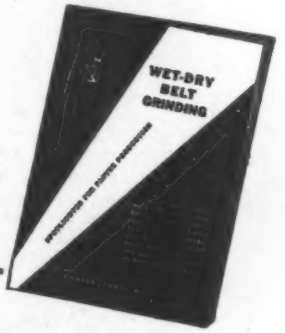
8 Different Operations Finished in a Flash!



1 — Chamfering
2 — Rounding
3 — Squaring
4 — Forming radii
5 — Grinding flat surfaces
6 — Grinding parallel surfaces
7 — Polishing
8 — Removing tool marks

Wet-belt surfacing *the Porter-Cable way* has rocketed into prominence since war production has been making such huge demands on plants. Why? . . . Because this highly modern machining method provides 5 to 50 times faster surfacing with close precision — *yet it's so simple that unskilled workers soon qualify as big producers.* The call is growing fast for operators with the "know how" of these Porter-Cable machines, that work equally well on hard and soft metals, alloys, plastics, fibre, hard rubber.

All you have to do with this amazing, new surfacing method is, in most cases, to present the surface to the belt free-hand . . . while the diamond-hard abrasive points do their cutting. Even for limits as close as .005", you need only the simplest fixtures. The result is, wet-belt surfacing is taking hundreds of jobs off work-loaded millers, shapers, grinders, lathes. The interesting details of this "machining revolution," are yours for the asking . . . shown in a simple, understandable way in Porter-Cable's latest booklet, "Wet-belt Surfacing," — virtually a textbook on the subject. Write for it today!



PORTER-CABLE MACHINE CO.
1702-3 N. SALINA STREET
SYRACUSE, N. Y.

PORTER-CABLE TOOLS

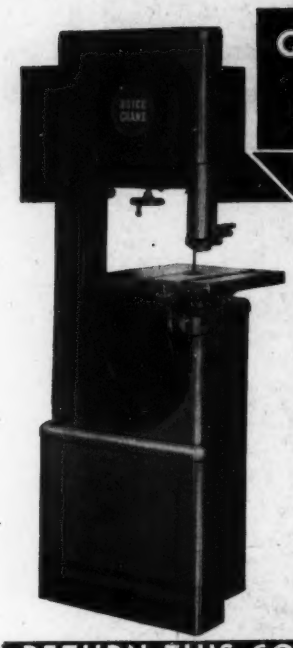
For Your Shop Projects And Maintenance Jobs

TAKE-ABOUT — The Dustless Sander. For fast, clean, smooth work — the choice of craftsmen everywhere. High-speed belt; sturdy, sustained power; light and finely balanced.

SPEEDMATIC SAW — Greater power efficiency, one-handed operation, true-balance make it the big work-saver and time-saver.

Speed Your School's WAR JOBS!

Women workers and newly trained operators find Porter-Cable's Wet-Dry Belt surfacers simple, safe and speedy to use. And school instructors, like hard-pressed production men everywhere, can reduce machining time and cost on their shop's war-production projects. Your Porter-Cable Wet-Belt Surfacers will pay for themselves in a hurry; besides, they'll reduce training time on many different surfacing operations.



QUICK SHOP EXPANSION EASY
WITH
BOICE-CRANE POWER TOOLS

Available Right Now!

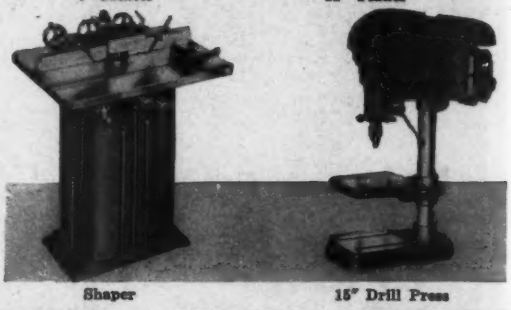
EVERY ONE A PRODUCTION PROVED TRAINING TOOL . . .

When emergency training of pattern makers and other skilled workers skyrockets shop equipment needs, Boice-Crane tools are the answer. With the same Boice-Crane machines, industry has already solved many similar problems. To provide enlarged and modernized shop facilities **quickly,** save yourself time, worry, and money by learning about these tools NOW!

IDEAL FOR QUICK SHOP EXPANSION

Every dollar you spend for a Boice-Crane machine does the work of two, compared to cumbersome oversize machines. Trimmed of every pound of excess weight but still rugged as a jeep. Compact. Easily moved—keeping your shop layout flexible to meet constant change in defense class needs. **Most shops can find room for enough Boice-Crane machines to care for dozens more trainees without actually adding a foot to their shops!** To make sure you get all the benefits of this modern kind of shop tooling get our catalog NOW!

6" Jointer 12" Planer



Shaper 15" Drill Press

RETURN THIS COUPON

NEW 48-Page Catalog FREE
☐ Check here for Metal Spinning Book

Name .....
Street .....
City .....
633

Detroit Public Library

Precision Built . . .

BANDSAWS • SHAPERS
LATHES • JIG SAWS
JOINTERS • DRILL PRESSES • SANDERS • PLANERS

BOICE-CRANE CO. 932 W. CENTRAL AVE. TOLEDO · OHIO *Shop Tested* POWER TOOLS SAFETY-ENGINEERED FOR SCHOOLS

(Continued from page 60A)

Philosophy of Industrial Arts Education — 20c
Fifty Full-Scale Drawings (Wood) — 35c
Index to Shop Kinks — 75c
Research Problems — 60c

Johnson & Son, Inc., Racine, Wis.
Handbook of American Trees and Wood Finishing
Teacher's Handbook on Care of Furniture
Wax Is Nature's Protection
Some Facts About Wax
Teaching Outline
100 Uses for Wax

Keystone Tanning & Glue Co., Williamsport, Pa.
Glue Handbook — 25c

Klise Mfg. Co., Inc., Grand Rapids, Mich.
The Book of Projects — 25c

Kuempel Company, Guttenberg, Iowa
How Clocks Are Built for Pleasure and Profit — 10c
Self-Reading Lumber Chart — 10c
Furniture Idea Book — 10c

LePage's, Inc., Gloucester, Mass.
Modern Adhesives and How to Use Them — 10c
LePage's Tool Craft Job Sheet
Do's and Don'ts for Gluing
Glue Facts

Mahogany Association, Inc., 75 East Wacker Drive, Chicago, Ill.
The Mahogany Book
How to Identify Genuine Mahogany

Maple Flooring Mfg. Ass'n., Stock Exchange Bldg., Chicago, Ill.
Color Harmony in Floors
Leaflet on Hard Maple Flooring
Home Builder folder

Masonite Corp., 111 West Washington St., Chicago, Ill.
Samples of Products
Literature on Products
Directions for Making Sewing Box and Tool Tray
Instructions for Making Sewing Cabinet
Display of Masonite Processes
"Story of Masonite"

J. H. Monteath Co., 202 Lewis St., New York, N. Y.
The Story of Balsawood
The Story of Greenheart
The Story of Teakwood
The Story of Lignum Vitae

Monite Waterproof Glue Co., Minneapolis, Minn.
Glue of the Ancients Gone Modern
Crafts Manual (Drawings)[2] — 25c

National Hardwood Lumber Ass'n., 2408 Buckingham Blvd., Chicago, Ill.
Rules on Measurement and Inspection of Hardwoods — 25c
Standard Specifications for Grades and Hardwoods and Cypress Lumber for Freight Cars and Locomotives — 15c
Standard Specifications for Structural Stress-Grades for Hardwoods and Cypress — 15c

National Oak Flooring Mfg. Association, Memphis, Tenn.
Years of Living With Enchanting Nofma Floors
How to Lay, Finish, and Care for Nofma Oak Floors
Architect's Specification Manual

Nicholson File Co., Providence, R. I.
A File for Every Purpose[3]
File Philosophy
Price List of Files and Rasps
Price List of Swiss Patterns
Hints on Files and Filing
Marks of a Good Poor Mechanic
More About Saw Filing
King Saul Knew About Files
Swiss Pattern Files
Working on Brass
Long Angle Lathe File
For Rough Touch Work

North Bros. Mfg. Co., Lehigh Ave., and American St., Philadelphia, Pa.
Yankee Tool Book
Reference Chart

Ohlen-Bishop Manufacturing Co., Columbus, Ohio
Saw Efficiency

Oliver Machinery Co., Grand Rapids, Mich.
Installation, Care, and Operation of Oliver Circular-Saw Benches
How to Get More From Your Band Saw
Installation and Operation of Band Saws

Pan American Union, Washington, D. C.
Life and Customs in Latin America — 10c

Frank Paxton Lumber Co., Kansas City, Kans.
Complete Catalog

H. H. Perkins Co., New Haven, Conn.
Reedcraft
Seatweaving
Price List of Chair Seating Materials
(No charge to authorized instructors on the above material)

Plate Glass Mfrs. of America, Pittsburgh, Pa.
Plate Glass Booklet — single copy free. Price quoted on quantities

Porter-Cable Machine Co., Syracuse, N. Y.
Abrasive Chart
Belt Abrasive Surfacing Booklet

Rogers Isinglass and Glue Co., Gloucester, Mass.
The Rogers Book of Woodworking Shop Notes

Simonds Saw and Steel Co., Fitchburg, Mass.
How to File a Cross-Cut Saw
Methods of Cutting Metal

[2]Offered free to purchasers of jumbo introductory package Monite Waterproof Glue (5 oz.).
[3]No charge when requested individually by teachers.

(Continued on page 65A)

MEN TRAINED WITH

SKILSAW TOOLS

ARE PREFERRED in INDUSTRY

...because industry prefers SKILSAW TOOLS!

SKILSAW DISC SANDERS—Speed up all grinding, filing, sanding and polishing on flat or curved surfaces of all materials. 6 MODELS.

SKILSAW DRILLS—Light, compact, powerful for faster, better drilling on every job from lightest lead holes to heaviest reaming. 23 MODELS.

It's just good sense to train new workers with SKILSAW TOOLS . . . the tools they'll find preferred in aircraft, tank and war plants everywhere! That way your students will make the shift to real production *easier* . . . reach peak output *quicker*. And they will learn faster . . . do perfect work sooner with these tools that are proved in industry itself.

SKILSAW TOOLS are lighter, more compact, more powerful. They're perfectly balanced for easier handling, easier learning. Ask your dealer to demonstrate SKILSAW TOOLS *today!*

SEND FOR THIS FREE CATALOG! It illustrates every tool in the SKILSAW line. Then ask your dealer to demonstrate them on the jobs you teach.

SKILSAW, INC., 5033A Elston Ave., Chicago, Ill.

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
Dallas • Los Angeles • Oakland • Portland • Seattle • Toronto, Canada

SKILSAW BELT SANDERS—For all "final-finishing" on flat surfaces of wood, metals, compositions. Belt widths: 2½, 3 and 4½ inches. 4 MODELS.

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

Huther Bros. Saw Mfg. Co., Inc.

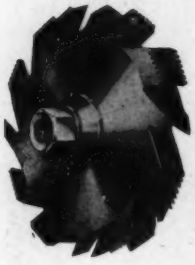
1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head



Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

Saw Vise

Setting Stake

These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

High Speed Knives

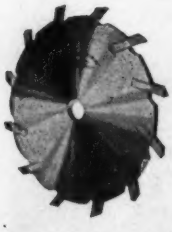
Shaper Stock, Ground Flat Stock

We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

Band Saws

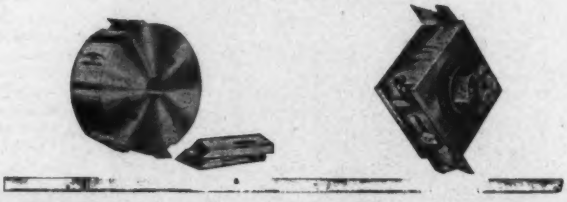
We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

Inserted Tooth Groover



This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

Cutter Heads for Saw Mandrel



Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

★ ★ ★ ★

FILING SAWS

Are You Training Students for War Industries?

Hundreds of schools are training tens of thousands of Defense workers to use modern methods and equipment. The Foley Automatic Saw Filer offers the proven, efficient way to sharpen saws, faster and better than can be done by hand. It is used by the Army, Navy, N. Y. A. Schools, and hundreds of manual training departments and industrial plants. Students quickly learn to operate the Foley Filer, which gives them valuable training in handling an automatic machine. If your saws are now being filed by hand, investigate the many advantages of the

Filing a Band Saw at the Stout Institute, Menomonie, Wis.

"We have a Foley Saw Filer and are convinced that it is the only machine of its kind that will do excellent work, and that with a little expereince a saw can easily and quickly be filed better than the majority of saws usually are. With the Foley equipment available, there is no more need of alibis for having saws unfit to work with."

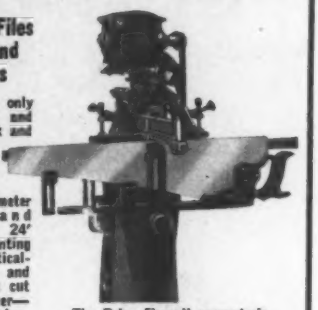
H. M. HANSEN, The Stout Institute.

★ ★ ★ ★

FOR VICTORY

One Machine Files Hand, Band and Circular Saws

The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cut circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner—stay sharp longer. Foley-filed saws have less breakage and last longer.



The Foley files all carpenter's hand, back, mitre-box and meat saws from 3 to 16 points per inch.

30-DAY TRIAL OFFER

The Foley is used by many schools. We want you to see for yourself in your own shop what a wonderful labor saving and efficient machine the Foley Automatic Saw Filer really is. Send for our booklet giving full details on new Model F-16 with many advanced features.

FOLEY AUTOMATIC SAW FILER

A FEW TYPICAL SCHOOL USERS

38 N. Y. A. Schools
U. S. Army Base Flying School, Montgomery, Alabama
U. S. Naval Academy
Beloit Vocational School, Beloit, Wis.
Frank Wiggins Trade School, Los Angeles
Alabama Polytechnical Institute
Board of Education, Rochester, N. Y.
Chicago (Ill.) Public Schools
El Cerrito (Calif.) Jr. High School
Phoenix (Ariz.) Public Schools
State Trade School, Danbury, Conn.
University of Missouri

FOLEY MFG. CO. 18 Second Street N. E., Minneapolis, Minn.
Please send me booklet and full information on use of the Foley Saw Filer in manual training departments, without obligation on my part.

Name .....
Address .....
School .....

Detroit Public

(Continued from page 62A)

Facts for Mechanics
Care and Use of Circular Saws in Woodworking Plants

Skilsaw, Inc., 5031 Elston Ave., Chicago, Ill.
Tools for Defense of America, Catalog No. 43
One and Two-Hand Operations With Skilsaw (folder on applications of this famous portable electric saw)

Soss Mfg. Co., 21777 Hoover Road, Detroit, Mich.
How to Obtain Beautiful Effects

Southern Cypress Mfg. Ass'n., Jacksonville, Fla.
Pecky Cypress
Tidewater Red Cypress for Interiors
The American Cypress and Its Uses — 10c

Southern Hardwood Producers, Inc., Memphis, Tenn.
Oak From Southern Hardwood Forests (available for teachers)
Southern Hardwood Interiors (available for teachers)
The Southern Hardwoods — 25c

Stanley Rule and Level Plant, New Britain, Conn.
Expert Soldering
The Steel Square
Stanley Tool Catalog
Joy of Accomplishment Booklet

Thayer & Chandler, 910 West Van Buren St., Chicago, Ill.
The Idea Book
Air Brushes

Tile-Tex Company, Chicago Heights, Ill.
Floors That Endure
Decorative Walls
Flexachrome

United States Department of Commerce, Superintendent of Documents, Government Printing Office, Washington, D. C.
You Can Make It for Camp and Cottage — 10c
You Can Make It for Profit — 10c
How to Judge a House — 10c
Furniture: Its Selection and Use — 10c
End-Matched Softwood Lumber and Its Uses — 5c
Industrial Uses for Small Dimension Stock — 5c
Light Frame House Construction — 40c
Marketing of Short-Length Lumber — 5c
Modern Connectors for Timber Construction — 20c
Sap Stains of Wood and Their Prevention — 10c
Treated Lumber, Its Uses and Economies — 5c

United States Department of Commerce, National Bureau of Standards, Washington, D. C.
List of Publications of Interest
Aid for Over the Counter Buyers
Quality-Guaranteeing Labeling Plan
Services of the National Bureau of Standards
Paints, Varnishes, and Related Products
Outside House Painting
Etching of Designs and Lettering on Metals
Guide to Literature on Rubber
Care of Floors
Luminous and Fluorescent Paints
Dead Storage of Automobiles

U. S. Plywood Corporation, 616 West 46th St., New York, N. Y.
Randalite Panel
Plyboard for Tennis Tables
Weldtex for Walls
American Hardwood Plywoods
Weldwood for Boats
The Plan Book for Boats
Flexglass — It Bends
The Soft Warm Beauty of Paneling
The Beauty of Panel
Panel for Sheathing and Building
Plywood for Schools
General Catalog
Making Concrete Forms With Plywood
Plywood for Residential Construction
(All available in limited quantities without charge.)

University of Nebraska, Lincoln, Neb.
Series of 40 Forging Exercises — 5c each

Walker-Turner Company, Inc., Plainfield, N. J.
Walker-Turner Machine Tools

Western Pine Association, 510 Yeon Bldg., Portland, Ore.
Wood Carving for Pleasure
Plan Book for the Boy Builder

Weyerhauser Sales Company, St. Paul, Minn.
The High Cost of Cheap Construction — 15c

Wood Finishing Division

Alabastine Company, Grand Rapids, Mich.
Color charts and description of following items:
Color It
Size It and Patch It
Art Colors
Water Colors

Aluminum Company of America, Pittsburgh, Pa.
Aluminum Paint Manual (free to teachers)
Finishes for Aluminum (free to teachers)

Berry Brothers, 211 Leib St., Detroit, Mich.
Natural Woods and How to Finish Them

Chicago Tribune, Chicago, Ill.
Refinishing Furniture — 7c

General Paint Company, Tulsa, Okla.
Basite
Kon Krete Kote
Floortite Sealer
Quick Step
Wall Cover
Heavy Kote
Flex

Grand Rapids Wood Finishing Company, Grand Rapids, Mich.
Purchasers' Guide, Listing Standard Products
Finishing With Shellac
The Story of Shellac

(Continued on next page)

Speed, ease in use, safety—these are the needs of industry, these are the qualifications of the Plumb Nail Hammer.

See, for example, how the sharp vise-like claws grip—able to easily pull nails, *even the heads,* through wood.

Head and handle are perfectly balanced for easy, accurate swing. Flared end of handle prevents slipping. Head is secured by exclusive Take-Up Wedge kept tight by the turn of a screw driver.

These are reasons to specify Plumb Nail Hammers, for performance and safety.

FAYETTE R. PLUMB, Inc. • PHILADELPHIA, PENNA.

PLUMB

HAMMERS • HATCHETS • AXES • SLEDGES

(Continued from previous page)

Better Wood Finishing (free to institutions and teachers, but small mailing fee is charged if requested for student classes)

Johnson & Son, Inc., Racine, Wis.
- *Handbook of American Trees and Wood Finishing*
- *Teacher's Handbook on Care of Furniture*
- *Wax Is Nature's Protection*
- *Some Facts About Wax*
- *Teaching Outline*
- *100 Uses for Wax*

National Paint, Varnish and Lacquer Assoc., 1500 Rhode Island Ave., N.W., Washington, D. C.
- *The New Paint, Varnish and Lacquer Catechism* (free to industrial teachers)
- *Why Paint Peels* (free to industrial teachers)

N. Y. State College of Agriculture, Cornell University, Ithaca, N. Y.
- *Kitchen Storage Space*—5c
- *List of Publications*
- *Bulletins for Homemakers*

Plate Glass Manufacturers of America, Pittsburgh, Pa.
- *Plate Glass Booklet* (single copy free; for quantities 25c or more each)

Savogran Company, Boston, Mass.
- *How to Repair and Refinish Furniture*

U. S. Department of Agriculture, Madison, Wis.
- *146 Occurrence and Removal of Glue Stains*
- *155 Wood Acids*
- *181 Coatings for Minimizing Changes in the Moisture Content of Wood*
- *186 Coatings That Prevent End Checks*
- *195 Some Books on Paints and Varnishes and Wood Finishing*
- *228 Aluminum Coatings for Moisture Proofing Wood*
- *249 Fire-Retardant Paints Containing Borax*
- *250 Treating Spruce and Balsam Fir Christmas Trees to Reduce Fire Hazard*
- *251 Prevention and Control of Decay in Dwellings*

William Zinsser & Co., 516 West 59th Street, New York, N. Y.
- *The Story of Shellac*
- *How to Use Shellac*

(*To be continued*)

A sound program of vocational education must include not only training, but *guidance* and *placement*. Schools furnishing vocational education should provide adequately for the guidance of pupils, and should cooperate with public employment offices in the initial placement and adjustment of those leaving the full-time school.

—*The Advisory Committee on Education*

Controlling Production so as Not to Interfere With Instruction

George M. McCarty and William C. Ash*

Production in school shops refers to the turning out of a marketable article or service. When, in the auto shop, work is done on a live car belonging to the instructor or some other customer, or, if in the beauty shop, hair-dos are given for a nominal fee we have examples of marketable services. Parts made in the machine shop, or benches, chairs, or tables made in the woodshop for school or industrial consumption serve as examples of marketable articles.

For a definition by way of contrast: an exercise is an operation or activity aimed at developing a particular skill. The finished exercise is not usable. A project is an activity developing a particular skill, in which the finished article has some use to the student. The production job goes into definite consumption.

Justification of Production

The advantages of production work are that: (1) The work is practical and is done in accordance with trade or industrial standards. (2) Material cost is reduced along with other savings to the school board. (3) Keener interest is developed on the part of the student because of the knowledge that he is doing real work and that the finished product is not something to be tossed into the scrap box. (4) Useful trade habits and skills are established under favorable conditions. Proper work attitudes are developed, and job planning and trade judgments are brought into play. (5) Since a production job might involve two or three different shops, the students learn something of the trades closely allied to their own.

Disadvantages which may develop are: (1) The student may get insufficient all around knowledge and skill. He may spend more time than necessary on one particular phase of the work. The trend may lean toward specialization rather than broad trade training. (2) There may be occasional exploitation of pupils developing out of the above-mentioned facts. It will be noted that these disadvantages are not inherent features, but possible developments. Sufficient foresight and constant attention will help to avoid such conditions.

It should be noted at this point then that production work is an advanced form of student activity. It is adaptable only to the latter part of actual vocational training. It has no place, in any appreciable degree, in junior high school exploratory work, or the beginnings of vocational training.

Production work then is not always a liability. If properly handled it is a very valuable asset and has a definite place in

(Continued on page 71A)

*Dept. of Vocational Teacher Education, University of Pennsylvania, Philadelphia, Pa.

BANISH TRAINING JITTERS

TIME is too short to nurse a trainee through "beginner's jitters" in handling heavy machinery. This is especially true now, when so many workers without previous mechanical experience—many of them women—must be trained to fill industry's manpower gaps.

That is one reason why Walker-Turner Machine Tools are so popular with vocational schools. Simple, modern design makes them easy and safe to operate and permits the student to concentrate on the project rather than on the machine. Rugged construction enables them to endure 24-hour training schedules with inexperienced trainees.

Then, too, training with Walker-Turner Machine Tools gives the students experience on the same types of machines they will use in industry. Priced to fit your school budget, Walker-Turner Machine Tools are available promptly for war production training.

WALKER-TURNER COMPANY, INC.
1933 Berckmen Street Plainfield, N. J.

Use SIMPLIFIED SAFE EASILY-OPERATED walker-Turner MACHINE TOOLS

Metal-Cutting Band Saw. Made in 14″ and 16″ models. Speed range 61 to 5300 s.f.m. permits cutting of practically any material from tool steel to wood.

Walker-Turner Metal-Cutting Radial Machine. Transverse travel of 21-1/2″, enables operator to cut wide material and various shapes. Patented geared motor insures utmost economy in use of wheels. Many other features.

Walker-Turner 20″ Drill Press. Made in several bench and floor models with or without power feed. Capacity up to 1″ in cast iron, 3/4″ in steel. Spindle speeds 260 to 5200 r.p.m.

walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

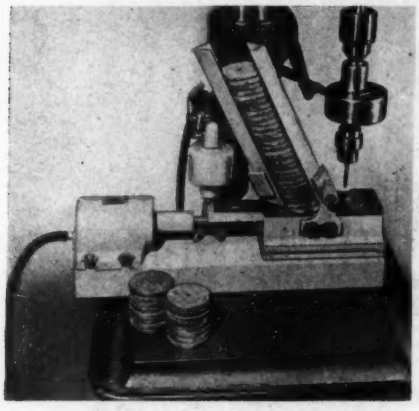
DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

Shop Equipment News

New Products — Publications

NEW WORK FEEDER

A new semiautomatic fixture for feeding and holding work while drilling and tapping operations are performed is announced by Mead Specialties Co., 15 South Market St., Chicago, Ill. This new timesaving fixture, known as the "Disk Feeder" reduces the work handling time involved in a variety of drilling and tapping operations. It will feed, hold, and eject work pieces within its capacity at the rate of 3000 to 5000 per hour, depending upon the size of the work. The "Disk Feeder" handles flat stock of a variety of shapes such as rounds, squares, rectangles, ovals, and irregularly shaped blanks. The model illustrated has an adjustable hopper capable of handling round, square, oval, or rectangular blanks, and a limited number of other shapes. The fixture can be quickly adjusted to accommodate work varying from approximately 1 by 3 in. in diameter (or 3 in. across the widest portion). The range in thickness is variable from approximately ⅛ to ¾ in.



New work feeder

By means of special attachments, small cylindrical work can be handled as readily as flat pieces.

For further information write to the address given.

For brief reference use IAVE—310.

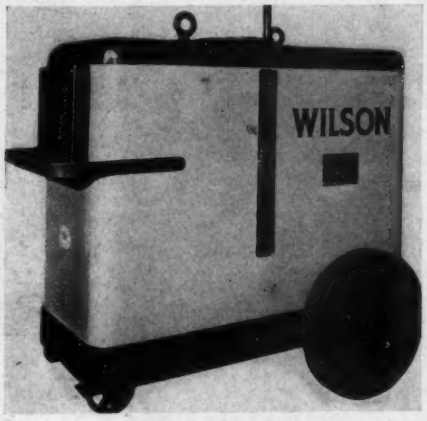
NEW IMPROVED A.C. WELDING MACHINE

A new a.c. transformer type welding machine that combines exceptional safety with improved operating efficiency is announced by Wilson Welder and Metals Co., Inc., 60 East 42nd Street, New York. The most interesting feature of the new Wilson "Bumble Bee" a.c. welder is its low open circuit voltage of 42 volts, automatically and positively maintained by means of recent Wilson engineering developments.

Two primary coils are used instead of the usual one, with a magnetic contactor in the circuit of one primary. Each primary contributes approximately 42 volts to the total open circuit voltage, which is actually 84 to 85 volts. However, when the machine is idle one primary is automatically cut out, restricting the open circuit value to 42 volts. As soon as the electrode contacts the work, the second primary is thrown into the circuit, and if there were not a dead short, the voltage would be 84–85 volts.

When the operator draws an arc, this open circuit potential of 84–85 volts enables him to establish his arc quickly and begin welding. Most welding operations are performed at between 32 and 40 volts. When welding is completed and the operator pulls out or lengthens his arc, the arc voltage rises. The moment it reaches 45 volts, the contactor opens and cuts out one primary, leaving only 42 volts in the open circuit.

Several other improvements incorporated in the new Wilson "Bumble Bee" make it an important advancement in a.c. welding. Power factor correction is provided with built-in capacitors on all four sizes — 300, 500, 750, and 1000 amperes — resulting in a power factor of 100 per cent to 86 per cent (lagging) over the popular working range. With Wilson's new wiring arrangement, capacitors are cut out when the machine is idle thereby conserving power and reducing costs.



A.C. welding machine

Additional features of the new Wilson "Bumble Bee" contributes to its life, performance, and appearance. It is portable and streamlined, and its 18-in. width permits easy passage through narrow doors. It has dual voltage connections for either 220 or 440 volts and thermal overload protection provided by a cutout coil buried in the winding. A single hand wheel control gives an infinite number of current adjustments throughout the NEMA range.

For brief reference use IAVE—311.

MEND-ALL WOODFORMING PLASTIC

The Gill Products Co., Inc., 606 W. Wisconsin Ave., Milwaukee, Wis., are marketing a Mend-All Woodforming Plastic which works like putty, does not shrink, takes stain, dries rapidly, and hardens like wood.

After hardening it will stick tight to metal, wood, cement, stone, or other surfaces and cannot be separated from them except by great force or the use of Mend-All Solvent, also manufactured by this firm.

For brief reference use IAVE—312.

JUSTRITE DRAWING INK CONTESTS

Justrite Drawing Ink has recently been added to the line of marking devices and stationery products manufactured by The Louis Melind Company of Chicago. The ink was tested two and one half years before being placed on the market, and has been accepted by drafting departments of leading schools and firms, as well as by commercial and other artists.

Offered in twenty waterproof colors, the ink comes in ¾-ounce quill-top bottles, and in 4-ounce, 16-ounce, and 32-ounce containers.

Two new contests are being announced at this time in fifty magazines and in newspapers. One for students and the other for professional artists. Entries for the contest are to be pen and ink drawings of some phase of America's Drive to Victory, and winners will be considered for art scholarships.

Entries will be accepted until April 1. For further information address Dept. 102, Louis Melind Company, 362 W. Chicago Ave., Chicago, Ill.

For brief reference use IAVE—313.

A NEW FILE FILOSOPHY

Nicholson File Co., Providence, R. I., has just announced a new booklet "File Filosophy," prepared to help tool users select the right file and use it correctly. Written in clear, simple language, "File Filosophy" is readily understood by students, mechanics, and production hands. The booklet contains 48 profusely illustrated pages which discuss the following subjects:

How a quality file is born; a bit of file history; file terminology; mill files; machinists' files; rasps; Swiss pattern files; curved tooth files; how to get the most out of files; draw filing and lathe filing; special purpose files; saw files and saw filing; precision filing; and sharpening tools and implements.

Copies of "File Filosophy" will be sent free to anyone who requests them.

For brief reference use IAVE—314.

CATALOG OF RED DEVIL LINE

Red Devil Catalog No. 18, illustrating and describing the famous line of Red Devil glass cutters, glaziers', and painters' tools and machines, has just been issued by Landon P. Smith, Inc., Irvington, N. J.

The 72-page book illustrates in full color the many styles of the Red Devil line of glass cutters, automatic glaziers' point drivers, wood scrapers, painters' cutlery, roller stipplers, electric paint conditioners, floor sanders, and other specialties and accessories.

For brief reference use IAVE—315.

CARBIDE TOOL GRINDERS TO "KEEP 'EM SHARP"

Bulletin No. 201 just published by the Hammond Machinery Builders, Inc., 1665 Douglas Ave., Kalamazoo, Mich., shows the complete line of carbide grinders, and gives full information on carbide tool maintenance.

Among the items mentioned is the Hammond combination chip breaker and cup wheel grinder which now accommodates up to 6-in. diameter diamond chip breaker wheels on the right side of the machine, and 6-in. diameter cup wheels on the left side.

For brief reference use IAVE—316.

DIAMOND TOOLS IN INDUSTRY

The Koebel Diamond Tool Co., Detroit, Mich., have issued a new catalog describing their formed diamond tools which are to be used for boring, facing, and turning the many different kinds of metals and materials now used by industry.

The catalog also pictures and describes the diamond tools which are manufactured by this firm for thread grinding, and single- and multi-point tools for straight and form dressing on grinding wheels.

This firm also distributes a book for men who have to be expert at grinding, in which precise but terse directions are given on how to dress a grinding wheel with a diamond tool.

For brief reference use IAVE—317.

MANUAL OF SIMPLIFIED RADIO SERVICING

Allied Radio Corp., 833 West Jackson Blvd., Chicago, Ill., announces the publication of a new pocket-sized manual of Simplified Radio Servicing, written by Major J. G. Tustison, U. S. Army Signal Corps, formerly electronics engineer with ERPI and Altec Service Corporation.

(Continued on page 70A)

TESTORS

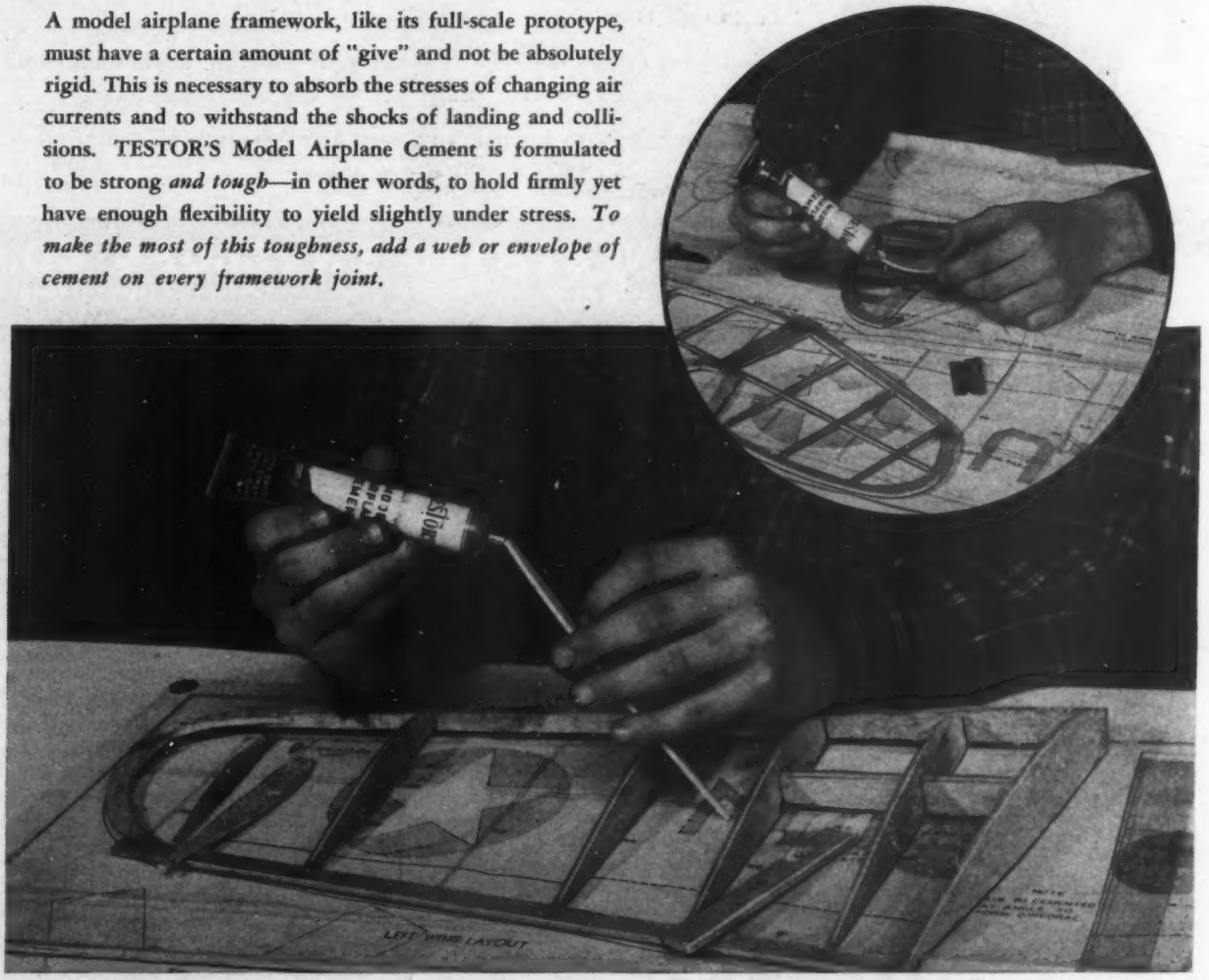
CEMENT AND DOPE FOR MODEL AERONAUTICS

FIRST CHOICE OF AMERICA'S MODEL BUILDERS

No. 3 in a Series on Principles of Better Craftsmanship

HOW TO MAKE STURDY FRAMEWORK

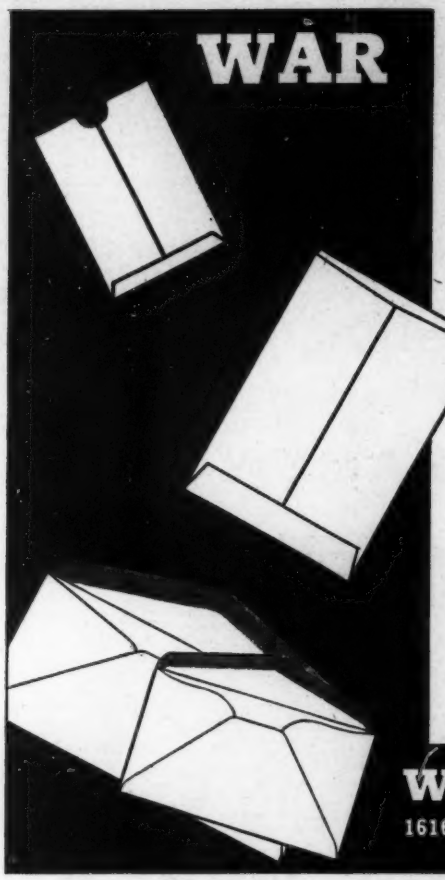
A model airplane framework, like its full-scale prototype, must have a certain amount of "give" and not be absolutely rigid. This is necessary to absorb the stresses of changing air currents and to withstand the shocks of landing and collisions. TESTOR'S Model Airplane Cement is formulated to be strong *and tough*—in other words, to hold firmly yet have enough flexibility to yield slightly under stress. *To make the most of this toughness, add a web or envelope of cement on every framework joint.*



You will find these practical data sheets a helpful guide for your classes. May we suggest that you save and file the entire series.

Now! Get complete details about Testor's Model Airplane Cements and Dopes

TESTOR CHEMICAL CO., ROCKFORD, ILLINOIS, U.S.A.



-- PEACE -- PROSPERITY -- OR DEPRESSION! . . . *you and your school will need envelopes*

And at the present time, during the greatest "push" for national defense, causing increased enrollment . . . you will be needing more than ever before, *filing envelopes, passbook holders, report card envelopes, and sundry other envelopes.*

Many school purchasing agents are placing their orders now while they are still able to secure good material. — Have you enough to take care of your increased demands? — If not, place your orders TODAY. The sooner the better for you. . . . Don't be caught short.

Send your orders in NOW so that your printing department can get your envelope requirements ready for the new semesters.

We'll be happy to furnish you with any envelope information.

WESTERN STATES ENVELOPE CO.
1616 W. PIERCE STREET MILWAUKEE, WIS.

(Continued from page 68A)

The booklet describes practical field-tested short-cut methods for servicing electronic and radio devices with only the simplest equipment and tools. Many methods described are those used by our armed forces for servicing equipment in the field of operations.

This manual will be especially useful in helping to train the thousands of students now taking radio courses and who are primarily interested in learning simple, yet effective, servicing methods.

Copies of this publication are offered free to school officials, librarians, and instructors engaged in radio vocational training programs who send their requests on official letterheads.

For brief reference use IAVE—318.

MILLING WITH HIGH-SPEED STEEL

The Cincinnati Milling Machine Co., Cincinnati, Ohio, have just published a helpful book entitled "Milling With High-Speed Steel."

The material covers information on how to design and mount the cutters, the speeds and feeds to use with them, the need and function of cutting fluids, and how to sharpen and store the tools.

A copy of this instructive booklet may be obtained by writing for it.

For brief reference use IAVE—319.

VOCATIONAL OPPORTUNITIES

"New Career Opportunities" is the title of a 24-page booklet published by the Johns-Manville Co. The purpose of this book is to call the high school graduate's attention to splendid new career opportunities offered by our oldest human endeavor, the building industry. Certain universities and colleges have arranged special courses designed to train young men and women for careers in light construction engineering and marketing.

Copies of this guidance booklet will be supplied in a limited number without charge or in larger quantities at $5 per hundred postpaid.

Johns-Manville Co., 22 E. 40th Street, New York, N. Y.

For brief reference use IAVE—320.

PRESIDENT OF TURNER BRASS WORKS RECEIVES ARMY PROMOTION

Major John Slezak, head of the tank branch of the Chicago Ordnance District and now acting chief of the industrial division, has been promoted to the rank of lieutenant colonel, as announced by Brig. Gen. Thomas S. Hammond, I. N. G. (Ret.) deputy district chief.

Colonel Slezak is on leave of absence from his position as president of The Turner Brass Works, Sycamore, Ill.

DELTA RECEIVES THE ARMY AND NAVY "E"

On Friday, January 15, 1943, the Army and Navy "E" Production Award was conferred upon the Delta Manufacturing Co., Milwaukee, Wis., and its employees, by Col. C. J. Otjen, commanding officer of the Wisconsin-Upper Michigan internal security district.

Acceptance speeches were made by H. Campbell Stuckeman for the firm, and by Ray Nelson for the employees.

DE VILBISS RECEIVES THE ARMY AND NAVY "E"

The Army and Navy "E" Production Award was presented to the DeVilbiss Company, Toledo, Ohio, on January 11, 1943. Lt. Col. T. H. Eickhoff, U.S.A., presented the Army and Navy "E" flag, and Allen D. Gutchess made the acceptance speech for the firm, and Paul Kesler for the employees.

NEWS NOTES

(Continued from page 57A)

base pay will be $2,600 per annum. These appointments, generally, will be for the duration of the war and in no case will extend more than six months beyond the war.

The U. S. engineers are also seeking men with two years college engineering, or equivalent experience in building construction, requiring the sinking of timber piles and/or substructure caissons. These men are to serve as inspectors of timber pile driving at ore docks now under construction at Escanaba, Mich. The base pay will range between $2,000 and $2,600 per annum. The appointments will be for a period of from six to nine months.

These employment opportunities are not open to those liable to early induction into the armed forces by reason of high classifications under the selective service act, or those presently deferred because of corrective physical conditions or dependency circumstances which would justify the reasonable assumption that they may soon be reclassified and inducted. No one *now* engaged in war work will be considered unless these positions require the use of higher skills than they are *now* using in their present employment.

File applications with P. J. Martin, representative, U. S. Civil Service Commission, Room 1107, New Post Office Building, Chicago, Ill. — Telephone: Wabash 9207.

♦ The U. S. Army Air Corps at Wright Field, Dayton, Ohio, has just issued their *second* appeal

(Continued on page 86A)

(Continued from page 66A)

vocational education. To control production, therefore, does not necessarily mean to curtail production. In the broader sense it might refer to going out and getting more production work in order to enrich and make more real the vocational training of the pupil.

In La Crosse, Wis., all vocational training is organized on a production basis with markets for all goods produced. The articles or services may go directly into industry, may be sold by merchants, may be used in the school system or may be transferred directly to the customer or consumer. J. B. Coleman and W. B. Opperman, in a discussion of the system say, "The production method of instruction without a market is out of the question. Adequate training for industry except by the production method is impossible."

Methods of Control

There may be three approaches to the problem of controlling production depending upon conditions in each instance: (1) curtailment of production, (2) fitting production to the instructional setup, (3) seeking more production.

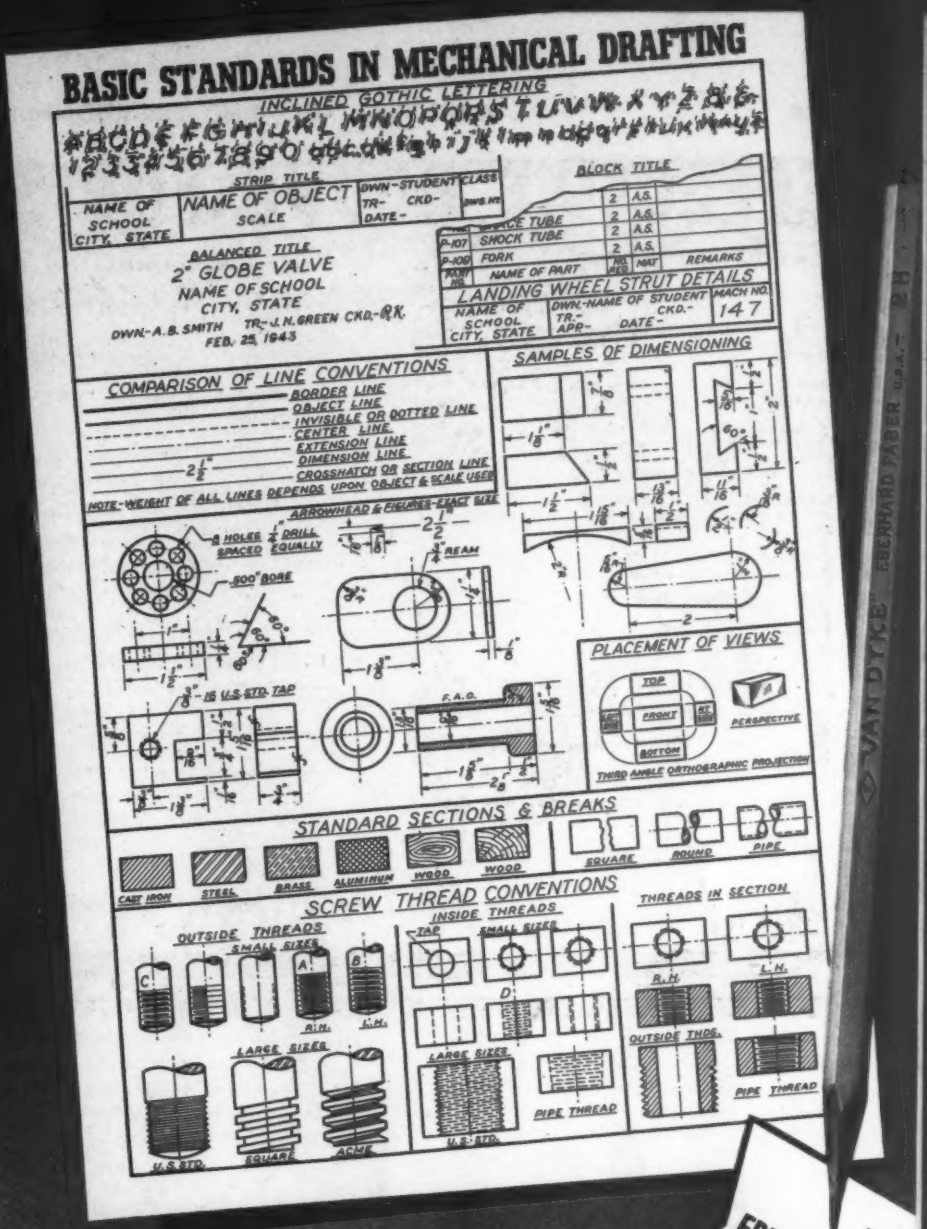
Curtailment of production: It will be necessary to curtail production if (1) the course of study does not adapt itself to production work, (2) if the type of production work available does not suit for arrangement in an instructional order or is not of sufficient variety or, (3) if pressure groups such as labor organizations or employers' organizations force curtailment because of competition. The last-mentioned condition would not ordinarily occur, but there is likelihood of it.

The actual steps to be taken in curtailing production will depend upon the source of the production work, and the organization of the school system in each particular instance. Some production work comes from the school board for consumption in the school system. In this case the steps taken would depend upon who is responsible, and to whom, and the manner in which the different departments of the school system are correlated. Where the production work is consumed in industry, the instructor may have direct control or may have to relay his requests to higher-ups. In cases where service is rendered directly for the customer as in auto repairs or beauty culture services, the instructor in practically every case has direct control and turns down work when it becomes excessive.

The instructor should have the right to refuse production work when necessary. This may be done directly or through a superior, but in either case it is definitely a supervisory responsibility.

Occasionally production work comes through which has to be done whether it

(Continued on next page)



The Natural Relationship

between sound basic instruction and good drawing pencils leads EBERHARD FABER to sponsor the issuance of a series of wall-scale reference charts on which are exemplified the essentials of standard drafting practice. Whether or not you are presently a user of our product, we invite you to send for the first chart of this series. It will be sent you without cost, and we will include one of our new MICROTOMIC "VAN DYKE" Drawing Pencil folders, presenting the story of the exclusive HI-DENSITY LEAD and its peculiar advantages.

AS A... EBERHARD FABER SERVICE...

to those who instruct in Mechanical Drawing we will send FREE a 16" x 24" WALL CHART like the above printed on heavy stock, for your classroom use.

EBERHARD FABER

LEADERSHIP IN FINE WRITING MATERIALS

SINCE 184...

EBERHARD FABER PENCIL CO., Educational Dept., 37 Greenpoint Ave., Brooklyn, N.Y.

Please send me, without cost, your No. 1 Wall Chart on Standard Practice in Mechanical Drawing and your new descriptive folder.

School

Name

Address

EFFECTIVE BOOKS FOR SCHOOL SHOPS

DRAFTING

Mechanical Drawing Problems — Berg and Kronquist. A practical, effective, two-year high-school course based on problems which develop knowledge and skill. Complete, Cloth, $1.28; Parts I and II, Paper, 58 cents each.

Machine Drawing Problems — Berg and Elleson. For third year. 96 cents.

Machine Drafting — Snow and Russell. Complete with problems and special information on strength of materials, calculating, design, etc. Cloth, $2.50; Paper, $1.48.

Beginning Mechanical Drawing Units — Roberts. Follows recommendations of the A.V.A. committee. $1.00.

Beginning Problems in Mechanical Drawing — Bennett. Junior high school. 56 cents.

Problems in Architectural Drawing — Elwood. Part I, frame, Part II, steel and masonry. $2.00 each. Planning Your Home — Ericson and Soules. $2.00.

BLUEPRINT READING

Problems in Blueprint Reading — Castle. Proved text. Explains conventions. Contains 39 problems ranging from block to machine assembly drawings. Widely used. 96 cents.

Learning to Read Mechanical Drawings—Bartholomew and Orr. Simple, yet effective, even with slow students. 40 cents.

Reading problems in Mechanical Drawing — Quinlan. Eight different problems. 25 cents.

WOODWORKING

Essentials of woodworking — Griffith and Cox. Easily understood treatment on hand tools, techniques, woods, and finishes. $1.36.

Woodworking Workbook — Nichols and Stiles. The last word for beginning students. Illustrations preview, study, exercises, and questions. 56 cents

Woodwork for Secondary Schools — Griffith and Cox. Machine woodworking. $2.00.

The Art of Wood Turning — Klenke. $2.00.

Woodwork for Beginners — Griffith and Cox. 32 cents.

ELECTRICITY

Basic Electricity — Feirer and Williams. Pre-induction text. Excellently illustrated. $1.92.

Practical Electricity for Beginners — Willoughby. Easily understood. $1.25.

Electric Motor Work — Willoughby. $2.50.

General Electrical Work — Willoughby. 56 cents.

GENERAL SHOP

General Shop Handbook — Willoughby. Basis for excellent course. $1.00.

RELATED SCIENCE

Machine Shop Science and Mathematics — Eaton and Free. Revised. Cloth, $2.00; Paper, $1.48.

Request special circulars of projects, block printing, leatherwork, art metal work, weaving, and other shop subjects.

METALWORKING

Aircraft Sheet Metalwork — Giachino. Complete treatment of all fundamental operations. Easy to read. Well illustrated. $1.96. Part II, Workbook, 96 cents.

Basic Bench-Metal Practice — Giachino and Feirer. Here metalworking fundamentals are so clearly explained and well illustrated even the poorest student can learn. Over 300 illustrations. Cloth, $2.75; Paper, $1.84.

Oxy-Acetylene Welding and Cutting — Giachino. Best all-around how-to-do-it text for beginners. Treats all types of work: welding, cutting, ferrous and aircraft alloys. Excellent illustrations. $1.96.

Sheet Metal Pattern Drafting and Shop Problems — Daugherty. Cloth, $2.50; Paper, $1.76.

Essentials of Metalworking — Berg and Wing. $1.48.

Elementary Forge Practice — Harcourt. $2.00.

Instruction Manual for Sheet-Metal Workers — Selvidge and Christy. Cloth, $1.75; Paper, $1.24.

PRINTING

Arithmetic for Printers — Aubel. The mathematics book for printers. $1.88.

The Practice of Printing — Polk. The standard text on letterpress printing. Handset and skillfully printed — itself an example of good craftsmanship. $1.80.

Elementary Platen Presswork — Polk. $1.50.

The Binding of Books — Perry and Baab. $2.00.

Type Charts — Polk. $1.00.

Publications of **THE MANUAL ARTS PRESS** *Peoria, Illinois*

(Continued from previous page)

interferes with instruction or not. This may be necessary because of savings to the school board or, possibly, because *orders are orders*. When this occurs the work can be best analyzed and handled in the light of what follows.

Fitting production work to the instructional setup: The term production method as applied to shop instruction, refers to a method of teaching as well as to shop organization and management that seeks to duplicate in the school shop actual working conditions and standards as they exist in the trade or in industry, and that involve instruction on productive work if not on a commercial product. The term is a rather general one for instruction given in connection with work on a productive basis.

Production work may be conducted in the following ways depending upon local conditions and requirements:

1. *Where industry furnishes materials:* In some school districts raw materials such as iron, bronze, or steel castings or drop forgings suitable for instructional purposes are obtained from industry free of charge, together with blueprints and specifications. The school makes no charge for the work. Industry in turn is lenient in allowing spoilage, and occasionally gives the school materials, service, and sometimes equipment. Under such an arrangement instruction is largely on practical work in accordance with trade standards and at a low cost to school district. It furthermore builds good cooperation between school and industry.

2. *Where the product is for the board of education:* Under this plan instruction in whole or in part is given on a product used by the school district operating the school.

3. *Where service is rendered for cost of material:* In auto shops students sometime work on live cars, the customer paying for the material used plus a small overhead charge.

4. *Where the product is sold:* Sometimes shop instruction is given on a product made in accordance with contract requirements for industry and sold to industry on a piece rate basis. The school assumes responsibility for spoilage and delivery. This is not very successful except in a few cases.

When the production job is first ushered into the shop, the instructor must analyze it in the light of skill difficulty, educational value, supplies, equipment, and time required to do the job. It is repeated that if the job is not suitable the instructor should have the right to refuse it. In some cases where unsuitable or excessive production work has accumulated, the instructor is kept on over the summer vacation to do the work. This is one method of control where a *Must* is attached to the job.

When applying production, the length of the course is an important factor. Production work does not adapt itself to short-term intensive courses. Evening and private school classes would fall in this category. In longer term trade classes production is advisable only after the student has acquired fundamental skills. The last two years of trade training have been found to be about the most appropriate time.

It will require intelligent planning on the part of the instructor in order to introduce the production work to each student at the proper time. Under such circumstances it would be very awkard to have a definite time set for completion of the work. The instructor should have sufficient time leeway to hold back a job in order to introduce the job at a more advantageous time in the pupil's activity. Once the pupil is started on a job however, there should be a time set for the job to be completed, in order that the pupil become conscious of his time and compare it with existing standards. This has been carried to the point of having a certain percentage of the student's grade governed

(Continued on page 74A)

Tannewitz DI-SAWS

are ESSENTIAL to Teaching MODERN Tool & Die Making

The innumerable and truly amazing time and money-saving shortcuts which may be effected by DI-SAWING is causing this equipment to be almost universally adopted by the leading shops. For inside and outside cutting, filing and polishing the DI-SAW is obsoleting other methods. Put the TANNEWITZ DI-SAW on your MUST list. Complete details of this exellent machine will be sent you promptly on request. Just ask for DI-SAW Bulletin.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

SHELDON

VOCATIONAL TRAINING

No. 100-24-DS
Open Frame Shop Bench

BENCHES

Our men in the front lines have the finest fighting equipment. The men behind the men at the front, those in industry engaged in the war effort, must also have the finest equipment. Sheldon vocational tables and shop benches, proved by over 40 years of experience, are the very finest obtainable. They are being used in civil and armed force training schools throughout the country.

Write today for our shop bench catalog.

SHELDON ALSO MANUFACTURES A COMPLETE LINE OF SCIENCE LABORATORY, HOME ECONOMICS, AND ART FURNITURE.

E. H. SHELDON & COMPANY
723 NIMS ST. MUSKEGON, MICHIGAN

Uncle Sam Says:

"Speed Up the School Defense Training Program NOW!"

With more and more men being called to the colors the all out war production program is urgently in need of trained men and women.

Every School Can Help

Industry today is filling its ranks with men and women trained in schools — but demand is running far ahead of supply. Which means, schools must train more men and women — and faster. This requires plenty of equipment, material and supplies. Uncle Sam says "Get what you need — and get it now!"

We Have What You Need

For over a generation, we have been supplying schools from coast to coast. Our service is so complete and comprehensive that it even includes planning and laying out of school shops. We're ready to serve your needs to the limit of our capacity not only on machinery, supplies and material but also on famous B-G Soft Textured, Kiln Dried Lumber (favorite among schools everywhere).

Time is of the Essence

— so consult (or write for) our big 1942–1943 catalog right now and order what you need to speed up your school training program that Victory may come sooner and be less costly. Wire, write or telephone — today.

B-G is National School Distributors for:

Atlas Press Co.
Champion Blower & Forge Co.
Cincinnati Tool Co.
Cleveland Twist Drill Co.
Columbian Vise & Mfg. Co.
Henry Disston & Sons
Millers Falls Co.
Osborn Mfg. Co.
Peck, Stow & Wilcox Co.
Standard Tool Co.
Stanley Tool Works
L. S. Starrett Co.
Walker-Turner Co.
and many others

BRODHEAD-GARRETT CO.

"Supplying School Defense Training Needs in All 48 States"

4560 East 71st Street **Cleveland, Ohio**

(Continued from page 72A)

by his time on the job according to a credit scale. In some cases students have to come after school hours to do work that runs over the allotted time. These measures serve as incentives to the student to be more efficient in his work, particularly so if grades and job time are posted for all in the shop to see.

In many cases it is advisable to break a rather large production job into smaller, more understandable units on the pupil's level. A desk or table to be made might constitute a three- or four-week job. It would be appalling to a student to be assigned a job on such a basis, whereas, if he is given a leg to make with the stipulation that it ought to be finished by noon tomorrow, he can readily understand and visualize his procedure.

A method of teaching and shop organization which adapts itself to production work is that suggested by R. W. Selvidge in "How to Teach a Trade." The trade is first analyzed into operations, the list of these operations constituting a trade analysis. For each operation instruction sheets are made up along with any information sheets necessary. The student first acquires skill in the fundamental, most widely used operations by working on exercises or projects. As he progresses he is given a copy of the trade analysis so that he knows what the operations in the trade are, even though he has not acquired skill in all of them. When he is ready for production work (this will depend upon the nature of the student, nature of the trade, and nature of the production job) the instructor helps him to analyze the job into operations. The important factor here is the number of new operations involved in the job. If too many are present the job is too advanced for the student. If no new operations are present, and the student has sufficient skill in the old ones, then the job has no educational value. One or two new operations are ordinarily sufficient. The student then is given information and instruction sheets regarding these new operations. He asks questions, then proceeds with the job. The instructor checks on him when he is performing his new operations. As the student advances still farther, he learns to analyze his own jobs into operations without a great deal of assistance from the instructor. Production work can be efficiently handled in this manner. It will be noticed again that production is not for beginners.

Acquiring more production work: If it is desired to procure more production work,

(Continued on page 78A)

Printshop Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

BELLOWS
- *a*) Hand, small size
- *b*) Electric, blower type

BLACKBOARD — permanent or portable

BOOKCASE — for reference books, catalogs, etc., sectional preferable

BRAYER — 6 or 8 in. for proofing

BRUSHES
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

BULLETIN BOARD

CABINETS
- *a*) Galley, for double column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school type, each to accommodate two California cases, job cases, case slides, galley slide, and copyholder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *j*) Type, complete with 24 full-size California job cases, double work band, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.

CANS
- *a*) Benzine, pint size
- *b*) Benzine, 5-gal. size
- *c*) Kerosine, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

CASES
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼ size, for ornamental borders
- *c*) Lead and slug, regular size, to hold laborsaving fonts of leads and slugs
- *d*) Metal furniture, to hold laborsaving fonts
- *e*) Rule, ¼ size, for brass rule

CHAIRS — teacher's and tablet arm

CHASE RACKS
- *a*) For platen presses
- *b*) For cylinder presses

CHASES
- *a*) For each size of platen press
- *b*) For cylinder press

COMPOSING STICKS — 6 by 2 in., 8 by 2 in., 12 by 2 in., and 18 by 2 in., adjustable

CUTTER
- *a*) Lead and rule
- *b*) Paper, lever type, 20 in., with pedestal. Should handle 20 by 26-in. sheet
- *c*) Paper, lever type, 26 in. or 30 in.
- *d*) Paper, lever type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

DESK — teacher's, with drawer compartments

DRYING RACKS
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

FOLDING BONES — for hand folding

FOLDING MACHINE — 20 by 26-in. size, 4 fold, two parallel and two right-angle folds, power

FURNITURE — iron, 2 by 4 to 10 by 15 picas

GALLEYS — Steel, 8¾ by 13 in., 6¼ by 23½ in., double column, and 12 by 18 in.

GAUGE PINS — spring tongue

GLUE POT — electric, 1-qt. size

IMPOSING TABLES
- *a*) 12 by 18 in., with iron top, including reglets and furniture
- *b*) 24 by 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 by 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 by 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

INK FOUNTAINS
- *a*) Short, for 8 by 12, 10 by 15, and 12 by 18 presses
- *b*) Long, for 10 by 15, and 12 by 18 presses

KNIVES
- *a*) Overlay, for make ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

LEADER BOXES

LEADERS
- *a*) 6, 8, and 10 pt., fine dot
- *b*) 8 and 10 pt., hyphen

LINE GAUGES
- *a*) Metal, brass, or steel
- *b*) Wood

METAL FURNACE — for recasting and refining type metal, used only with typesetting machines

MITERING MACHINE

NUMBERING MACHINES
- *a*) For use on presses
- *b*) Hand machines

ORNAMENTS
- *a*) Assorted floral and decorative designs
- *b*) Border, 6 and 12 pt., decorative

PERFORATOR
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

PLANER
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple, with leather top

PRESSES
- *a*) Cylinder, two revolution, four roller, 25 by 38, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 by 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 by 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 by 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 by 18, with cabinet
- *f*) Proof, 20 by 24, with cabinet

PUNCH
- *a*) Foot power, multiple with assorted punches
- *b*) Lever, two die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

QUOINS
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

RULE — plain and brass (fonts to fit quarter cases)
- *a*) 2 pt., laborsaving, hair line, side face
- *b*) 2 pt., laborsaving, 1 pt. side face
- *c*) 1 pt., laborsaving, 1 pt. face
- *d*) 2 pt., laborsaving, double face

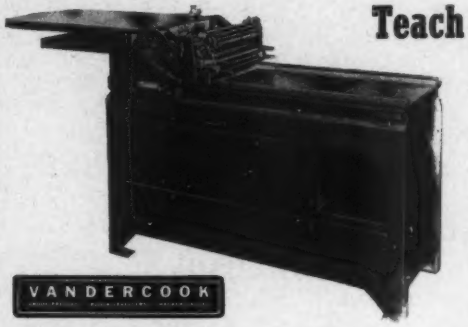
SAW TRIMMERS — pedestal type, with point gauge, and raising and lowering table

SPACING MATERIAL
- *a*) Iron furniture, as selected
- *b*) Leads, laborsaving, 2 pt.
- *c*) Leads, 2-ft. strips, 2 pt.
- *d*) Slugs, laborsaving, 6 pt.
- *e*) Slugs, 2-ft. strips, 6 pt.
- *f*) Spaces and quads

(Continued on page 76A)

SCHOOL PRINTING PLANTS by ATF

For the complete school printshop—from the small general printing unit to the large vocational trade training unit—ATF has everything you need to equip your plant with modern, safe equipment. ATF Education Engineering Service is available to help you lay out a new plant, or revise your present setup to provide more modern facilities. There is no charge for this service. Consult your ATF sales representative, or write to the American Type Founders Education Department.



Teach with Equipment Great Plants Use

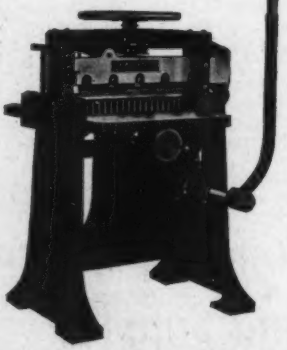
The No. 3 Vandercook Proof Press is a recognized favorite with leading printers everywhere. It is also ideal for teaching cylinder makeready, color register and how to get proper ink distribution.

In addition, the No. 3 Vandercook is a practical machine for printing programs, display cards and other school jobs. Ask your ATF representative, or write for details.

"The Best Type in Any Case!" ATF TYPE

For years, instructors have found ATF types best for the school printshop. Authentic designs of hard foundry-type metal, consistently and accurately cast, give the students a product that stimulates their pride. The types set easier, print better for a longer length of time, and distribute easier; the jobs look better set in ATF types and encourage the students. The ATF Spartans, Stymies, Lydians, Garamonds, Bodonis, Caslons, Centurys and Copperplates are on many an order these days. How about yours?

Specimen sheets of ATF types are available for class use.



Safe! The *Challenge* Lever Paper Cutter

A strong well-built cutter that is highly recommended for the school printshop. Operates easily, smoothly, cuts accurately. Made in two sizes: 26½ inch and 30½ inch.

Equipped with safety lock that prevents accidental descent of knife. All-steel lever is scientifically curved to provide maximum leverage. Structural features include solid center support, overhanging arch; easily squared back gauge; duplex steel measuring tape, graduated in both 1/12 and 1/16 inches; and six-spoke clamp wheel.

A *Challenge* PRODUCT

Hamilton Equipment for Schools

No. 19191 School Type Cabinet

No. 9188-A School Press and Materials Cabinet

No. 12013-D School Type Cabinet

No. 13983 Imposing Table 51439

The full line includes several styles of type cabinets and imposing tables designed for vocational instruction needs ...and many auxiliary cabinets for binding work and other purposes.

MADE BY *Hamilton*

American Type Founders Education Department

200 Elmora Avenue Elizabeth, New Jersey

The *HOME FRONT* is *Well ARMED!*

Before Pearl Harbor it was *defense* training — now it is **VICTORY TRAINING!** Thousands of men and women, unskilled before December 7, 1941, tackled with zest America's tremendous industrial job as *the Arsenal of Democracy.* These home front warriors, now thoroughly trained, have both spirit and tools to build the weapons that spell **Victory** for the United Nations! *Textbooks have played no small part in the unfolding drama of war training.*

INTERNATIONAL Textbooks SERVE

the nation's war effort — in schools, colleges and in Victory Training programs, because they are *authoritative* and *reliable* — because they meet the textbook requirements of a country at war training for Victory. They give necessary information *clearly* and *concisely, splendidly illustrated* to leave not a shadow of doubt in the student's mind.

Here is a *Partial List of BEST SELLERS*

Advanced Mechanical Drawing for High Schools	$1.75
Aircraft Metal Work	$1.80
Airplane Drafting	$3.50
Arithmetic I, II	$1.50, $1.00
Bench Work	$1.25
Dies and Die Making	$1.90
Drilling Machines and Practice	$1.50
Electrical Drafting	$2.55
Electrical Measuring Instruments	$1.65
Electric Welding I, II	$2.10, $2.60
Elementary Mechanical Drawing for High Schools	$1.60
Elements of Algebra	$1.25
Elements of Blueprint Reading	$1.00
Elements of Photogrammetry	$1.75
Gages, Jigs, and Fixtures	$2.25
Gas Welding and Cutting	$2.55
Geometry and Trigonometry	$1.25
Green-Sand Molding	$1.80
Grinding Equipment and Practice	$2.05
Household Mechanics	$1.34
Machine Shop Handbook	$1.00
Measuring Instruments	$2.10
Milling Machine and Practice Work	$1.50
Mold-Loft Work	$2.15
Patternmaking I	$2.00
Plastics — Problems and Processes	$3.00
Reading Shop Blueprints	$1.80
Ship Drafting	$3.35
Slide Rule and How To Use It	$1.00
Steel Square	$1.50
Tempering and Heat Treatment of Steel	$1.45
Toolmaking	$1.80
Useful Shop Tables and Information	$ .50

Let us send **EXAMINATION COPIES** of these books. Write for our new **Victory Training Textbook** catalog.

INTERNATIONAL TRAINING FOR VICTORY TEXTBOOK COMPANY

SCRANTON, PENNSYLVANIA

(Continued from page 74A)

g) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

SPECIMEN DISPLAY BOARD

STAPLE BINDER — pedestal type, foot power

STITCHER — wire, power, capacity ½ in. or ¾ in., flat- and saddle-back tables

TWEEZERS — 3½ in.

TYMPAN PAPER (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

TYPE
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job, lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt.; 12 pt., No. 26; 12 pt., No. 27; 12 pt., No. 28; 18 pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt., Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *j*) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30, and 36 pt.
- *k*) Job, heavy copperplate Gothic — 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
- *l*) Wood, condensed Gothic — 8, 12, 15, and 18 line

TYPESETTING MACHINES
- *a*) Either linotype or intertype, 2 or 3 magazines, and molds
- *b*) Matrices for same, 6, 8, 10, and 12 point, as selected

Printshop Supplies

BENZINE OR GASOLINE — for cleaning type or presses

BINDERY TAPE — 2 in. wide, brown or black

GOLD BRONZE — pale

INK
- *a*) Bond, black, for bond papers
- *b*) Book, black, for school papers, etc.
- *c*) Cover, colors as selected
- *d*) Dryers and compounds, as selected
- *e*) Half tone, black
- *f*) Job, colors as selected
- *g*) Metallic, gold and silver
- *h*) Process, black, red, yellow, blue

KEROSINE — for cleaning rollers

PADDING CEMENT
- *a*) Cold
- *b*) Hot

PAPER
- *a*) Bond, fine grade, 17 by 22 — 20, white
- *b*) Bond, medium grade, 17 by 22 — 20, white
- *c*) Bond, sulphite, 17 by 22 — 20, white
- *d*) Bond, sulphite, 17 by 22 — 20, colors as selected
- *e*) Book, enamel, 25 by 38 — 80, white
- *f*) Book, machine finish, 25 by 38 — 80, white
- *g*) Book, eggshell finish, 25 by 38 — 60, white
- *h*) Cover, as selected, 20 by 26, medium
- *j*) Card Bristol, fine grade, 22 by 28 — 4 ply, white
- *k*) Index Bristol, medium grade, 25½ by 30½ — 110, white
- *l*) Index Bristol, medium grade, 25½ by 30½ — 140, white
- *m*) Mill Bristol, medium grade, 25½ by 30½ — 140, colors as selected
- *n*) Pressboard, red
- *o*) Strawboard, No. 40 or No. 50
- *p*) Tagboard, manila, 24 by 36 — 140
- *q*) Tympan, to fit presses
- *r*) Wrapping paper, size as selected
- *s*) Holder for same

PASTE
- *a*) Bindery
- *b*) Make ready

TWINE — cotton, for tying jobs

WIRE STITCHING
- *a*) No. 25 round wire for stitcher
- *b*) Wire staples, ¼ in.

Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

If possible, each shop should have access to a projector, so that stills, silent movies, or sound movies, may be used also in the student's industrial arts and vocational education courses.

ADJUSTABLE-CURVE RULER

BEAM COMPASS

BENCH BRUSHES

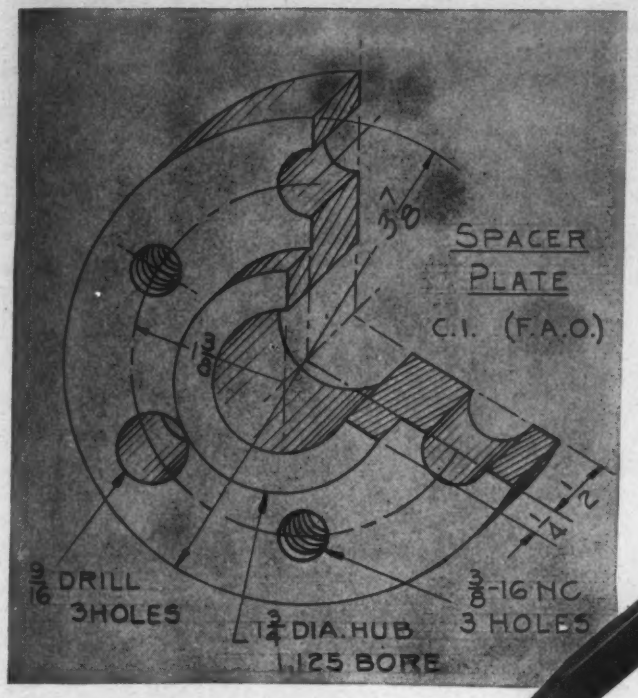
BLACKBOARD
- *a*) Permanent or portable

BLUEPRINT
- *a*) Frame or machine
- *b*) Washing trays or washer
- *c*) Paper tube, airtight
- *d*) Drying rack or dryer

BOOKCASE

CABINET
- *a*) For filing drawings
- *b*) Compass, 15 in., with locking device
- *c*) Drawing set: T square, straightedge, triangle, and protractor

(Continued on next page)



PROBLEM: Ask your students to draw the correct orthographic views of this Spacer Plate. *Typhonite* ELDORADO degrees recommended: 2H and 3H.

SOLUTION: We'll send you a free blueprint showing the problem's solution if you write to address at right within 30 days, specify Blueprint No. 128-J3.

LET THEM TACKLE THIS ONE!

Your students are going to like this assignment. It's not too tough, not too easy—but just ingenious enough to be interesting. And it's a mighty instructive problem at that. We'll send you the solution in blueprint form—without cost.

They'll like *Typhonite* ELDORADO pencils, too. And to prove it, they'll turn in better work. Drawings done with this excellent professional pencil are sharper, cleaner, more opaque—the blueprint easier to read. You'll never know what a big improvement a better drawing pencil can make until you give *Typhonite* ELDORADO to your students.

SCHOOL BUREAU, PENCIL SALES DEPT.
JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.

TYPHONITE
ELDORADO

(Continued from previous page)

b) For storing drawing boards
c) For storing drawing instruments
d) For storing models

CALIPERS — 6 in. and 8 in., inside and outside
CHAIR — teacher's
DESK — teacher's
DIVIDERS — proportional
DRAFTING MACHINE — and accessories
DRAFTSMAN'S STEEL PROTRACTOR
DRAWING BOARDS — large
DRAWING-BOARD SUPPORTS — to be set on or attached to woodworker's bench
DRAWING TABLES AND STOOLS
a) For students
b) For teachers
INK-BOTTLE HOLDER
IRREGULAR CURVES — Nos. 17, 21, and 24, wood, rubber, or transparent
LETTERING ANGLES
LETTERING PENS — assortment of 12
LEVEL OR TRANSIT — builders' for architectural students
LEVELING ROD — for use with the transit
MACHINISTS' COMBINATION SET — 12 in.
MARKING PINS — for use with measuring tape, for architectural students
MICROMETER — 1 in., for mechanical-drafting students
OILSTONE — 3-in. case
PANTOGRAPH — 21 in.
PARALLEL RULES
PLANIMETERS
PLUMB BOB
SHEARS — for trimming blueprints and drawings
SPEED COUNTER — for mechanical-drafting students
STEEL SCALES — 12 in.
STOP WATCH — for mechanical-drafting students
TABLE
a) For cutting and trimming drawings and blueprints
b) For disassembling and reassembling machine parts and models
TAPELINE
a) 100 ft., steel, for architectural students
b) 50 ft., steel or metallic
TOOLBOX — containing 1 machinists' hammer, one 6-in. adjustable wrench, one 6-in. screw driver, one 6-in. combination pliers
TRIANGLES
a) 30-60 deg., 14 in. transparent
b) 45 deg., 10 in. transparent
TRIANGULAR SCALES — civil engineers' type, 12 in.
T SQUARE — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
WALL CHARTS — lettering, decimal equivalents, etc.
YARDSTICK

To be provided by, or for, each student

Drafting—Small Equipment

DRAWING BOARD — size to be specified by instructor
DRAWING INSTRUMENTS — as specified by instructor
ERASING SHIELD
IRREGULAR CURVE — Nos. 8 and 13, transparent
PENCIL COMPASS
PENHOLDER — for lettering pens
PENS — assorted, for lettering
PROTRACTOR — not over 5 in.
SCALE — 12 in. architects', triangular
SCALE GUARD
SLIDE RULE — 10 in., as specified by instructor
T SQUARE — to fit drawing board
TRIANGLES — 30-60 deg., 10 in. transparent, and 45 deg., 8 in. transparent

Drafting Supplies

BICHROMATE OF POTASH — crystals
BLUEPRINT
a) Paper, 36 in. wide
b) Writing fluid
PAPER
a) Cross section, 8½ by 11 in.
b) Detail, 24 by 36 in.
c) Drawing, 24 by 36 in.
d) Isometric, 7 by 10 in.
e) Tracing, 36 in.
POWDER — for tracing cloth
TRACING CLOTH — 36 in.
VAN DYKE
a) Fixing salts
b) Paper, 36 in.
c) Writing fluid

Drafting—Additional Supplies

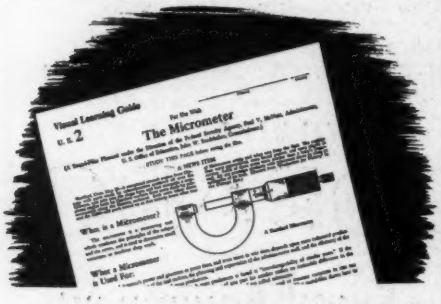
To be provided by, or for, each student

ERASERS
a) Cleaning
b) Ink
c) Pencil
INK
a) Black, waterproof
b) Colored, if required
PENCILS — DRAWING, HB, 2H, 3H, 4H, and 6H
PENCIL POINTER PAD
THUMBTACKS OR SCOTCH TAPE

Pre-induction TRAINING

High schools throughout the nation have been called upon by the War Department to include a course in *"The Fundamentals of Shop Work"* as a part of the Pre-Induction Training Program. Sound films produced by the U. S. Office of Education and the Army and Navy have been strongly recommended as an integral part of the instruction.

In order to promote complete student understanding and assure permanent retention of the film lesson, the National Audio-Visual Council have designed a series of Visual Learning Guides. The Guides are simple, inexpensive four-page folders that prepare the student for intelligent viewing of the films, provide a quiz for self-testing means of recording correct answers, and self grading. They also provide a series of subjects for class discussion and reference sources for continuing study.



VISUAL LEARNING GUIDES

Cover the Following Subjects

U. S. 1	The Steel Rule
U. S. 2	The Micrometer
U. S. 4	The Verniers
U. S. 47	Drill—Locating Holes, Drilling and Tapping in Cast Iron
U. S. 6	Lathe—Rough Turning Between Centers
U. S. 19	Shaper—Cutting a Keyway on a Finished Shaft
U. S. 11	The Milling Machine
U. S. 40	Laying Out Small Castings
U. S. 41	Fundamentals of Filing
U. S. 34	Cutting Thread with Taps and Dies
U. S. 35	Scraping Flat Surfaces
U. S. 36	Fitting and Scraping Small Bearings
U. S. 37	Reaming with Straight Hand Reamers
U. S. 38	Reaming with Taper Hand Reamers
U. S. 46	Drilling a Hole in a Pin
U. S. 48	Countersinking, Counterboring and Spotfacing
N. 70	Useful Knots
E. 1	First Aid

Visual Learning Guides are sold only in packages of 50

Net price $1.45 per package

Be sure to list code numbers when ordering GUIDES

National Audio-Visual Council, Inc.
160 North LaSalle Street
Chicago, Illinois
Gentlemen:

Please send me the Visual Learning Guides listed below.

School _____

Attention of _____

Address _____

City _____ **State** _____

Ship _____ **packages of Guides**

List Guides desired by Code Nos. _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____, _____

☐ **Check or money order enclosed.** ☐ **Ship C.O.D.**

Detroit Public Library

(Continued from page 74A)

or production work of a different variety, the individual acting in a supervisory capacity will have to contact the sources of this production. These may be the board of education, industrial establishments, merchants, or individual customers.

It is an easy matter for him to investigate in the board of education, unless there is some personality conflict or conflict of ideas regarding production work. The board is always interested in saving money.

In contacting industry, he will have to sell his product to the executive involved. The same thing applies with merchants or individual customers. In the latter two cases it may be necessary to do a little advertising. This selling and advertising may sound far fetched to some, but it is being done. One need only study the extent to which school production has been carried in La Crosse, Wis. When dealing with industry, merchants, or individual customers the supervisory individual may find opposition from either employers or labor groups, on the grounds that the school is furnishing competition. These can be handled but that is not the purpose of this paper.

Summary

Production is justified on the grounds of more real instruction and savings to the school board. In our methods of control we must not lose sight of these facts. Control may be through three channels, curtailing production, fitting production into the instructional setup, and in a much broader sense, getting more production. Production work is not suited for beginners. The instructor must have a free hand as regards organizing or refusing production work.

Bibliography

Methods and Teaching Problems in Industrial Education, F. Theodore Struck (New York City: John Wiley and Sons).

How to Teach a Trade, R. W. Selvidge (Peoria, Ill.: The Manual Arts Press).

A Manual for Instructors in Civilian Conservation Corps, U. S. Office of Education.

"School Production for the Market," *Industrial Arts and Vocational Education,* June, 1938.

"Production in School Shop," *Industrial Arts and Vocational Education,* December, 1937.

A Paper, "Controlling Production so as not to Interfere With Instruction," Arnold Daffin, December 11, 1937.

Progress Records for the Automobile Shop

LESTER BROWN* and D. L. DOWNING**

Timken Vocational High School operates a complete auto servicing shop. The shop compares in most respects with a commercial garage and in appearance is quite similar to one. There is enough room for ten cars to be serviced at one time. Time allotment is on the usual vocational basis; e.g., students spend three hours a day in shop and three hours in related and other classes.

Repair jobs are chosen for instructional value only. Each repair job must be sponsored by a student. He must assume the responsibility for seeing that the work is completed satisfactorily for the customer. This sponsoring gives him practice in meeting the public which is of great importance in his educational experience. This plan works more satisfactorily than attempting to do direct public repair work. The owner places confidence in the student when he allows that student to bring a car to school. The statement given to the *customer* when the car is taken in says "The repair work being done on your automobile is taken in for its instructional value to apprentices. The school assumes no responsibility for damages resulting from defective parts or workmanship." The customer must agree to leave his car long enough for students to complete the work.

When one considers that several thousand repair jobs come into an auto-servicing shop during the course, one sees a great problem in keeping individual student records. When this department started, over three years ago, we found that prospective employers wanted to know what a student had accomplished during his schooling and what could be expected of him when he started to work. It was apparent that some type of individual record had to be kept. An outline of the course would not give the right picture because a definite course of study is not uniform for all students. It is impossible to have all students cover the same operations.

(Continued on page 80A)

*Instructor, Vocational Auto Mechanics, Timken Vocational High School, Canton, Ohio.

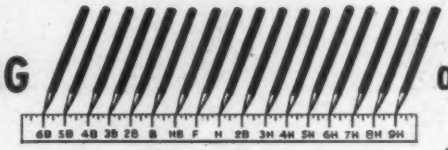
**Associate Professor of Vocational Education, University of Akron, Akron, Ohio.

Check what you want in a drawing pencil!

☐ **STRONG POINTS** that stand up when you bear down

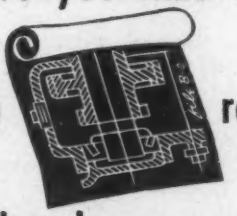
☐ **SMOOTHNESS** that will speed your work

☐ **PRECISION GRADING** accurately spaced



☐ **DURABILITY** to save you time and money

☐ **OPACITY** for sharp reproduction of every line



☐ **CLEAN ERASURE** that leaves no "ghost lines"

CHECK THEM ALL? THEN GET THEM ALL, IN

EAGLE "CHEMI-SEALED"
(SUPER BONDED)

TURQUOISE

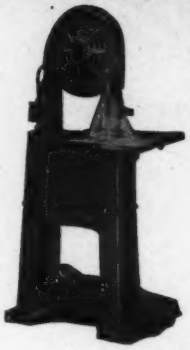
DRAWING PENCILS AND LEADS

FREE TEST SAMPLE!
Just write us, naming this magazine and your regular pencil dealer, and we will send you a TURQUOISE pencil or lead, in any grade you desire.

* Reg. U. S. Pat. Off.

EAGLE PENCIL CO., 703 EAST 13th ST., NEW YORK • **EAGLE PENCIL CO. OF CANADA, LTD., TORONTO**

WALLACE
"MACHINE-OF-THE-MONTH"



No. 16 Bandsaw

16" diameter wheels. 8" capacity under guide. Standard wheel speed, 1100 r. p. m. Blade speed, 4600 feet per minute. Geared motors, direct-connected ½, 1, and 2 h. p. Built-in light. Net weight, 335 lbs.

For fine cabinet and furniture work, the Wallace No. 16 Bandsaw has no equal.

Geared motors step up wheel speed, — permit faster, smoother and easier cutting. Dynamically balanced wheels make blade breakage miserly.

Swivelling table, exclusive Wallace feature, permits use of rip fence for accurate resawing.

Write today for bulletins, — we also manufacture quality-built universal saws, jointers, lathes, mortisers, shapers, glue pots, grinders, etc.

J. D. WALLACE & COMPANY
140 S. CALIFORNIA AVE. CHICAGO, ILL.

Needed in High Schools — NOW!

Miller's FUNDAMENTALS OF ELECTRICITY
A new VICTORY WAR BOOK for Pre-Induction Courses . . . Clear, direct, practical course based on Bulletin PIT-101 of the War Department and the U. S. Office of Education.

Moore's ELEMENTARY AVIGATION
Pre-Flight Training . . . A one-semester course which can be taught by high school mathematics and physics teachers with no specialized knowledge of aviation.

Brown's AIRPLANE MODELS AND AVIATION
First Course in Model Building . . . Brief book addressed directly to the student, who enjoys producing workmanlike models and flying them himself while learning some basic concepts of aviation . . . Diagrams and progress tests.

W. W. Hart's BASIC MATHEMATICS
Streamlined survey or refresher course . . . Fundamentals for future aviators, navigators, artillerymen, and mechanics, and for those who plan to study engineering, science, navigation, or military science . . . Also a *Brief Edition* for a one-semester course.

D. C. HEATH AND COMPANY
Boston - New York - Chicago - Atlanta - San Francisco - Dallas - London

(Continued from page 78A)

There are many types of progress records used in many different trades. Many trades teach operations in a certain fixed order. As a student completes one operation satisfactorily he progresses to the next operation. This type of instruction lets each individual advance as rapidly as possible. The fast learning student is not held back with the slower learning student and the slower student need not necessarily keep up with the fast student. The progress records are in the order in which the different operations occur. The instructor can tell at a glance which student has been completing the most work satisfactorily and which students are behind. The amount and quality of work is taken into consideration on most progress records. The first year an attempt was made to use a progress record of the conventional type and it was found to be impractical in the auto-mechanics trade.

It is not the purpose of this article to discuss the advantages and the disadvantages of different types of progress records. An attempt is made to explain the type of progress record used in the auto shop at Canton. The progress record consists of mimeographed forms containing a complete list of all the jobs that are undertaken in a repair garage. The list was compiled by *Motors Magazine*, and is published in the form of a flat rate manual. The list covers all makes of automobiles from 1935 to date. All jobs that are listed in the manual have time studies that were compiled by time study experts and have definite labor charges calculated for each job on each make of automobile. Of course the time studies were made on the performance of skilled auto mechanics and not for students in a vocational auto shop.

On the left side of the student progress record there are job numbers. These job numbers are exactly as they appear on the job list of the *Motors* flat rate manual. This numbering saves time and mistakes when the student uses the manual. In the next column the name of the job appears; this is what the student depends on to classify his job. The third column is blank and has the heading, *Year and Make*, which means the name of the automobile and the year model. This column is filled in by the student when he starts the job. There is another blank column marked *Date* which means the date that the job was started. The fifth column which is headed *Time* is also filled in by the student and it means the actual number of hours spent on the job. The last column to be filled in by the student is headed *F.R.* or flat rate. When a job is completed the student goes to the flat rate manual for the charge for doing this job on this particular car. This figure is calculated in dollars and cents, and is the figure he puts in the *F.R.* column.

The *F.R.* (flat rate) column has many advantages. The first thing it does is to give the student an idea how long it should take a skilled mechanic to complete a job. The student realizes what is going to be expected of him some day. When he checks the flat rate he learns how much money he would have earned in an actual commercial garage. Frequently he finds that he wouldn't make a very good living at his present rate of speed. An incentive is thus given which stimulates better effort and a working speed comparable to that of the journeyman mechanic.

In auto mechanics accuracy comes first. The student must first learn to do the job right. Speed is expected to result from practice. This idea is fine but many jobs do not occur often enough in a school shop to drill for speed, therefore the student must know what is expected of him when he becomes a skilled mechanic. A student may get the idea after he has completed several similar jobs that he is just as good as a full fledged mechanic. This idea is wrong if he does not have the speed, because any job can be completed satisfactorily if enough time is spent on it. When a student can complete a job satisfac-

(Continued on page 84A)

Industrial Arts and Vocational Education Subscriber's Service

We invite inquiries and questions on all problems relating to the organization, planning, and equipping of your school shops. For equipment and supplies the advertising of manufacturers in this issue will serve as a convenient guide, and your requests to these advertisers will bring immediate response.

Use the post card on this page. It will promptly bring from the manufacturers the information requested. A "keyed" alphabetical list of supplies and equipment is given for ready reference and your convenience. Insert the key number of any products in which you are interested, sign, detach, and mail the card—no postage is required if mailed in the United States. *For items of equipment or supplies not included in list please write us a special letter; or include item after "Remarks" on post card, as we can put you in touch with all sources of supply.*

This service is limited to supervisors, shop instructors, and officials responsible for the specification and purchase of equipment and supplies in school shops.

KEYED PRODUCT CHECKING LIST FOR SOURCES OF SUPPLY

If You Desire Catalogs, Information, or Have Any Questions On Two or More of These Products Write the "Key Number" On the Post Card, Sign, and Mail to Us.

1—Abrasives, Cloth—Belt
2—Abrasives, Grain
3—Abrasives, Paper
4—Abrasives, Waterproof
5—Acid Swabs and Brushes
5a—Air Compressors
6—Aluminum, Bars, Sheets
7—Aluminum, Oxide Cloth
8—Ammeters
9—Anvils
10—Anvil Tools
11—Aprons, Shop
12—Arbor Presses Supplies
12a—Arc-Welding sets and equipment
13—Archery Equipment and
14—Art Metal Tools
15—Asbestos Soldering Blocks
16—Auto Mechanics' Tools
16a—Automotive Test Equipment
17—Auto Trailer Plans and Parts
17a—Axes
18—Babbitt Metal
19—Band Saws
20—Band Saw Blades
21—Band Saw Brazers
21a—Band Saws, metal cutting
22—Band Saws, Portable
23—Band Saw Sets
24—Bar Iron
25—Basketry Supplies
26—Battery Chargers
27—Belting
28—Benches
29—Bench Legs, Metal
30—Bench Metal
31—Bench Stones
32—Benches, Manual Training
33—Benches, Stake Plate
34—Bench Vises
35—Blackboard Drawing Sets
36—Blacksmiths' Tools and Supplies
37—Blowers and Compressors, Air
38—Blow Pipes, Brazing, Jewelers'
39—Blowtorches
40—Blowers, Forge
40a—Blue-Print Cabinets
41—Blue-Printing Machines, Electric
42—Blue-Print Paper & Cloth
43—Books (Specify Subject)
44—Bookbinders' Supplies
45—Borers, Wood
46—Braces and Bits
47—Brass, Sheets, Bar
48—Brass Furnaces, Gas
49—Brazing Torches
50—Bristol Board
50a—Brittania Metal
51—Bronze Sheets, Bars, etc.
52—Brushes, Artists'
53—Brushes, Circular, Bristle and Wire (All Kinds)
54—Brush Conditioner, Paint
55—Brushes, Paint and Varnish
56—Brush Making Materials
57—Buffers, Bench, Pedestal
58—Buffs, Polishing
59—Bushing Removers
59a—Burners—Bunsen or Laboratory
60—Cabinet Hardware
61—Cabinets, Filing
62—Cabinets, Storage (State Kind)
63—Calipers
64—Cane for Chairs
64a—Carving Machines, Wood
65—Carving Tools (Specify Kind)
66—Casting Outfits
67—Castings, Project
68—Carved Wood Moldings
69—Cements, Jewelers'
69a—Cement, Keene's
70—Ceramics
70a—Chairs, Folding
71—Charcoal Blocks
72—Charts
73—Chasing Tools
74—Chisels (State Kind)
75—Chucks, Independent, Universal, Combination
76—Chucks, Drill
77—Circular-Saw Benches
78—Clamps
79—Clamps, Bar
80—Clay, Natural
81—Clock Movements
82—Conduits
83—Coping Saws
84—Coping Saw Blades
85—Copper, Sheets, Bars
86—Core Ovens
87—Countersinks
88—Crucibles
89—Cut-off Saws
90—Cutter Heads
91—Cylinder Printing Presses
92—Dado Heads
93—Decalcomania
94—Desks, Teachers'
95—Die Makers' Supplies
96—Dowel Pointers
97—Doweling Jigs
98—Drafting Tables
99—Drafting Instruments
100—Drawing Inst. Repair Parts
101—Drawing Boards
102—Drawing Paper — Equipment and Supplies (State Kind)
103—Draw Plates
103a—Drilling Machines
104—Drill Presses
105—Drill Sharpeners
106—Drill Stands, Bench, Post, Pedestal
107—Drills
107a—Duplicators
108—Dynamometers, Electric
109—Electric Generators
110—Electric Motors, Power Units
111—Electric Motors, Construction Sets
112—Electrical Instruments
112a—Electric Multi-Meters
112b—Electric Oscillators
113—Electrical Parts and Supplies
114—Emery Paper, Cloth and Powder
114a—Emery Wheel Dresser
115—Enamels
116—Engravers' Tools and Supplies
117—Envelopes
118—Exposure Meters

The School Shop Service Bureau will save your time and the expense of writing to individual firms to establish convenient and reliable sources of supply. We urge the use of this Service Bureau. Additional cards may be had on request.

INFORMATION WANTED

We are interested in the following items as checked below, and will appreciate receiving the information requested, promptly.

☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐

(Check) Catalogs.....Prices.....Information.....Manufacturer's Address....

Remarks: .....

Name .....
Please Print

Title ..... School .....

City ..... State .....

Keyed Product Checking List for Sources of Supply: Continued

118a—Fasteners, staple
119—Felt, Cloth
120—Felt Wheels and Buffs
121—Fiber Cord
122—Files and Rasps
123—Filing Machines
123a—Films
124—Finishing Kits
125—Fire Brick and Cement
126—Fire Clay
126a—First Aid Kits and Materials
127—Flasks
128—Flexible-Steel Tape Rules
128a—Flexible Shaft and Motor Outfits
129—Flexible Tubing
130—Flint Paper
130a—Flock and Flock Guns
131—Floor Sanders
132—Flux, Soldering
133—Forges, Gas
134—Foundry Supplies and Equipment
135—Frequency Meters
136—Furnace Linings
137—Furnaces, Annealing, Case-Hardening, Heat-Treating, Metal Melting
138—Furniture Finishes and Supplies
139—Furniture Trim
140—Furniture Weaving Frames
141—Fuses, Standard
142—Galvanometers
143—Garnet Papers
143a—Gas Welding equipment and supplies
144—Gauges, Printing, Cabinet, Rule and Square
145—Gauges, Wire, Etc.
146—Generator Test Benches
147—Glass Cutter
147a—Glazing tools
148—Glue
149—Glue Pots
150—Gouges
151—Grinders and Buffers
152—Grinder Attachments
152a—Grinders, Bench
153—Grinding Compound
154—Grinding Wheels
155—Grinding Wheel Dresser
156—Hacksaws
157—Hacksaws, Power
158—Hacksaw Power Blades
159—Hammers
160—Handicraft Supplies Oxyacetylene
161—Hand Screws
162—Heat-Treating Equipment
163—Hinges
164—Inks, Drawing and Colored
165—Inks, Printing
166—Inlays
167—Jewelers' Tools and Supplies
168—Jig Saws and Blades
169—Jointers, Bench
170—Jointers, Hand
170a—Keene's Cement
171—Kits, Projects
172—Kits, Metal Projects
173—Knife Grinder
174—Knives, Sloyd, Manual Training, Stencil and Wood Block
175—Knives, Machine
175a—Knives, band
176—Knock-Down Furniture
177—Kraftsmen Kits
178—Laboratory Standard Instruments
179—Lacquers
180—Lamps, Alcohol
181—Lamps, Miniature
182—Lathe Attachments
183—Lathes, Metalworking
183a—Lathes, Metal Spinning
184—Lathes, Woodworking
185—Leather-Working Tools and Supplies
186—Letters and Figures for Stamping Metals
187—Levels
188—Linoleum Blocks, Supplies
188a—Lockers, Workbench
189—Looms
190—Lumber
191—Machine Lights
191a—Machinists' Tools
192—Mallets
192a—Manual Training Tools and Supplies
193—Metal Craft Tools and Supplies
194—Metal Shears, Electric
195—Metals, Sheet
196—Metal Spinning Equipment
197—Mica
197a—Micrometers
198—Milling Machines
199—Miter Boxes
200—Model Boat and Airplane Parts
201—Modeling Clay
202—Modeling Tools
203—Mortisers
204—Motor Generator Sets
204a—Nippers, Cutting, Jewelers'
205—Ohmmeters, Portable
206—Oilstones, Bench
207—Outlets, Switchboxes
207a—Oxy-Acetylene sets & equip.
208—Paints, Projects Finishing
209—Panel Boards, Electric
210—Pantographs
211—Paper, Drawing and Tracing
212—Paste
213—Pencils, Drawing
214—Pencils, Electric Etching
214a—Pencil Pointers
215—Pens, Ink Shading
216—Pens, Lettering
217—Pewter
218—Picture Frame Moldings
219—Phase Angle Meters
220—Picture Frame Tools
221—Planes, Hand
222—Planers and Surfacers (Wood)
223—Plans and Directions
224—Plastic Wood
224a—Plastic wood solvents
225—Pliers
226—Plywood
227—Porcelain Knobs, Cleats
228—Plastic Materials
228a—Portable Electric Drills
229—Portable Meters, Indicating
230—Portable Woodworking Machinery
231—Pottery Supplies
232—Presses, Veneer
233—Power Hack Saws
234—Printshop Equipment and Supplies
234a—Project Service
235—Protractors
236—Punches
237—Radio Parts
237a—Radio Test Equipment
237b—Radio Tube Testers
238—Reeds and Raffia
239—Resistance Boxes, Plug and Dial Resistors
239a—Revolution Counters
240—Rheostats
241—Routers
242—Rubber Stamps
243—Rubber Type Sets
244—Rules, Wood, Boxwood, and Combination
245—Sanders (State Type)
245a—Sanders, Belts
246—Sanders, Portable
247—Sanding, Discs
248—Sandpaper
249—Saws, Circular
250—Saw Filing Machines
251—Saw Sets
252—Saw Trimmers (Printing)
253—Saws
254—Saws, Portable Electric
255—Scrapers, Hand and Cabinet
256—Screw Clamps
257—Screw Drivers
258—Scroll Saws
259—Semi-Precious Stones
260—Shapers, Electric
261—Shapers, Metalworking
262—Sharpening Stones
263—Sheet-Metal Tools and Equipment
264—Shear Grinder
264a—Silversmith's Tools and Supplies
265—Slide Rule
266—Sloyd Knives
267—Sockets and Receptacles
268—Soldering Coppers
269—Soldering Furnaces
269a—Soldering Irons, Electric
270—Solders, All Kinds
271—Special Auto Mechanics' Tools
272—Spindle Carver
273—Spray Painting Equipment
273a—Spray Painting Booths
274—Squares
275—Stains
276—Stakes, Arts and Crafts
277—Steel, Sheets, Bar, Stainless
278—Stencils—Marking
279—Stencils—Silk Screen Process
280—Starters, Motor, Electric
281—Steel Rules
282—Steel Squares
283—Stencil Knives
284—Stools
285—Storage Battery Testing Instruments
286—Switchboards
287—Switchboxes
288—Switches, Safety
288a—Tables, Steel
289—Tachometers, Electric
290—Tacks, Thumb, Steel, Brass
290a—Tackers
291—Tape, Measuring
292—Taps and Dies
293—T Squares
294—Tenoners
295—Thermometers
296—Test Equipment, Electrical
297—Tongs
298—Tool Boxes
299—Tool Charts
300—Tool Checks
301—Tool Post Grinders, Electric
302—Tool Grinders
303—Tool Holders
303a—Tool Stands
303b—Tool Storage Equipt.
304—Torches, Alcohol, Gasoline
305—Transformers
306—Universal Saw Benches
307—Upholstery Materials and Supplies
308—Valve Regrinders
309—Valve-Spring Compressors
310—Variety Saw Benches
311—Varnish and Stains
312—Veneers
313—Vises, Metalworking
313a—Vises, Saw
314—Vises, Woodworkers
314a—Visual education
315—Voltmeters
316—Waterproof Abrasive Papers
317—Wattmeters
318—Weaving Materials, Furniture
319—Welding Equipment, Electric
319a—Welding equipment, oxy-acetylene
320—Welding Equipment,
321—Wheel Pullers
322—Wood Carvings
323—Wood Dyes
323a—Wood Forms
324—Wood Trimmers
325—Wood-Turning Lathes
326—Woodworking Shapers
327—Woodworking Tools and Supplies (State Kind)
328—Wrenches

FIRST CLASS
PERMIT No. 1112
(SEC. 510 P. L. & R.)
MILWAUKEE, WIS.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

2c-POSTAGE WILL BE PAID BY—

1943 MARCH SHOP ANNUAL—
WARTIME SERVICE EDITION

P. O. BOX No. 2068 MILWAUKEE, WIS.

Industrial Arts Service Bureau has been set up as a convenience and additional service of BRUCE-MILWAUKEE to conserve your time and save your money. We urge you to avail yourself of the assistance offered and will deem it a pleasure to extend our "Sources of Supply" research to your problems.

Announcing . . .

A NEW up-to-date basic text for the study of *Electricity* in high schools, trade and vocational schools, and a reference book of fundamentals for junior high schools

FUNDAMENTALS OF APPLIED ELECTRICITY

By E. W. JONES, B.S., E.E., M.S.
Associate Professor of Physical Sciences
Kansas State Teachers College, Pittsburg, Kansas

A book which combines all phases of electrical theory with an unusual number of practical applications, making it equally suitable as *classroom text* or *shop manual*

Thorough in Content—

The book is divided into two parts:

***Part I* gives fundamental principles and applications covering electrical units, circuits, and apparatus; the performance, care, upkeep, and cost of operation of common consuming devices; and safety rules. All are presented by explanation, picture, example, and demonstration, based upon pupil activity at every step.**

***Part II* is unique in offering directions which will assist teacher and pupils to design and build cheaply well-made shop equipment, demonstration apparatus, and class projects, which may be difficult to buy at this time.**

An *Appendix* contains useful tables and lists, including places to purchase shop equipment and supplies.

Unusual are the chapters on radio, small motors, transformers, and electricity in the home.

Rich in Teaching Aids—

Each chapter in Part I ends with a variety of teaching aids:

1. **A *summary* of chapter content, for review and reference.**
2. **Four varieties of *review and test questions*, to help organize teaching content and gauge student progress.**
3. **One or more *experiments* which may be used for demonstration lectures by the teacher or performed by students.**
4. **Suggestions for *special student activities* such as reports, shop projects, field trips, etc.**
5. **A list of reference books.**

An abundance of carefully chosen *illustrations*, frequent reference from principles to well-known examples or experiences of everyday life, and brief historical sketches, with authentic pictures of famous men, add to the effectiveness of this text.

There is enough material for a full year where shopwork is alternated with classwork.

FUNDAMENTALS OF APPLIED ELECTRICITY more than fulfills the requirements of "Standards of Attainment in Industrial Arts Teaching" adopted by the American Vocational Association.

Write for a copy of this important new text for thirty days' study.

THE BRUCE PUBLISHING COMPANY
703 Montgomery Bldg. Milwaukee, Wis.

Minnesota
SUMMER SESSION
Department of Industrial Education
COLLEGE of EDUCATION

★

Separate Enrollment for Either or Both Terms
June 15 - July 24 or July 26 - August 28

★

Four-year Curriculum—B.S. Degree
Master's Degree — Plans A-B-X-Y
Individual Plans for Ph.D.
Industrial Arts and
Smith-Hughes, George-Deen Courses
Excellent Library Facilities
Unexcelled Recreational Program
Wide Range of Manipulative Courses

★

Correspondence concerning credit transfer, graduate status, and advanced programs, should be addressed to the Department of Industrial Education, 200 Eddy Hall. Four-year curriculum and advanced patterns upon request.

Bulletins of the Summer Session may be obtained by writing to the Director of Summer Sessions,
1009 Administration Building

UNIVERSITY OF MINNESOTA
Minneapolis, Minnesota

For Young **MANPOWER** *in the Making!*

SHOP MATHEMATICS AT WORK
BLUEPRINT READING AT WORK

By Rogers and Welton

And still the demand for industrial manpower grows! These two books were specifically written to help you train that manpower. They have no frills. They *don't* include everything from paperhanging to brick-laying. They *are* simple, accurate, easy-to-use and easy-to-teach workbooks which provide just the *kind* and *amount* of training in these fundamental skills required in new workers *by industry itself*. Give your boys and girls, today, the competence they will need to make good in industry — tomorrow!

Write for complete information.

SILVER BURDETT COMPANY

New York • Chicago • San Francisco

(Continued from page 80A)

torily and also equal the flat rate time of the manual, he can justly feel that on that particular job he has attained the skill of a mechanic.

In the Timken School, as in many schools, grading is on a percentage basis. The grades must be on report cards every six weeks. Grades below 70 per cent are to be looked upon as failures. In the past, after the grades were received by the students, many arguments came up such as these:

"I completed a lot of work the past six weeks and I only got a 75. Why did you give me such a low grade?" or, "I did twice as much work as John and he got a higher grade than I did. I don't think that is fair."

Any student has a right to question his grade. Also, he has the right to ask his instructor concerning the reason for a certain grade. When this progress record is used each student can figure where he stands in the class and will soon discover from it what kind of grade he will receive. This record removes the personal feeling between student and instructor when the time comes for grading. At the end of each six weeks the students total the time and F.R. columns and the instructor uses this total as a grading score.

The last column is the score column and is checked by the instructor after he has inspected the job. If, in the instructor's mind, the student has done an excellent job he receives an *A*. If the job is satisfactory on the first inspection or placed in a satisfactory condition after first inspection the student receives a *B*. If the student is careless, uses an excessive amount of time, or the job is too difficult for his ability he is removed from that particular job and is given a *C*.

The *C* jobs are subtracted from the *B* jobs thus providing a penalty. A bonus is given for *A* jobs.

This type of progress record forces the student to learn to use a flat rate manual and to do it willingly. It also teaches him to write down the jobs he has completed, for no matter how many jobs he may have done, he gets credit only for the ones he has recorded. This progress record relieves the instructor from the endless task of bookkeeping, and makes grading easy and accurate. This type of progress record is an incentive for students to work because they can see for themselves how much they accomplish.

At the end of two years when a student completes his auto-mechanics course he keeps his progress record for future reference. A summary of the record is also kept in the school office. In this manner the future employer has a record of the student's training. The blanks on the progress record let the student and the employer know what jobs occur in the automobile repair trade in which the student has had no training as well as those in which training was received.

THE WORKER

He comes into the shop each day,
A smile upon his face,
His happy disposition
Seems to brighten up the place.

He doesn't wait for you to say
"Here's something you can do,"
He sees the task, he does it well,
Then looks for problems new.

He gets a lot of pleasure
Out of working all day long,
And when the quitting bell rings out,
He still is going strong.

'Most every time he gets a chance
He runs down to the shop,
To ask if he can lend a hand,
Seems as though he just can't stop.

Too bad there aren't more like him,
So we could each have one,
We could overlook some others,
And teaching would be fun.

— Leonard E. Schmidt
Lincoln Hall Vocational School,
Lincolndale, N. Y.

INCREASE WARTIME TRAINING EFFICIENCY with Campbell Finishing Products!

For Directors, Supervisors and Shop Instructors, the M. L. Campbell Company offers special products to help streamline and speed-up Shop work to meet present war-industry needs. You'll find it pays to "Call on Campbell."

Some of Campbell's Shop Aids:

- Dry Stains
- Water Soluble
- Spirit Soluble
- Oil and Lacquer Soluble
- Stick Shellac
- Quick Drying Varnishes
- Nitro Cellulose Lacquers
- Ethyl Cellulose Lacquers
- Enamels
- Fillers
- Sealers
- Bleaches
- Removers
- Thinners
- Shellac Enamels

You can save time and money by buying now on one order. Let us submit bids on your requisitions for school finishing supplies.

FREE Get Your Copy of Campbell's Descriptive Price List describing dozens of other products and authentic techniques of wood finishing.

YOU CAN COUNT ON CAMPBELL

M. L. CAMPBELL Company

"Fine Finish Leadership for 25 Years"

704 E. 19th St. KANSAS CITY, MO.

Specify

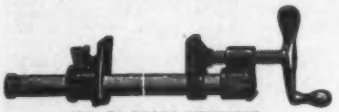
"Jorgensen" CLAMPS

for

HIGHEST QUALITY

NO. 70 JORGENSEN STEEL "I" BAR CLAMP

NO. 40 JORGENSEN STEEL BAR CLAMP



NO. 50 PONY FIXTURES

8 types of steel Bar Clamps with patented Multi-disc Clutch that slides to position and grips rigidly-squarely at any desired point; and 4 Types of Pony Fixtures (with exclusive patented Multi-disc Clutch) that go on ordinary pipe to make Clamps of any length.

HAND SCREWS

The "Jorgensen" Trade Mark on the jaws of all genuine Jorgensen Handscrews guarantees: selected grain, aged and treated jaws that will not split; Handles that will not loosen; Right-Left Screws that speed operation; Clamps that take a firm grip at any angle and hold it.

A Complete Selection

- "Jorgensen" Drop Forged "C" Clamps
- "Jorgensen" Welder "C" Clamps
- "Jorgensen" Malleable "C" Clamps, 4 types
- "Pony" Miniature "C" Clamps, 14 types
- "Colt" Eccentric Bar Clamps, 5 types
- "Pony" Malleable Lathe Dogs

Write for No. 16 General Clamp Catalog

ADJUSTABLE CLAMP CO.

"The Clamp Folks"

424 N. Ashland Ave., CHICAGO

★ ★ ★ ★ ★ ★ ★ ★ ★

Investigate these Star Tools

Use inexpensive staple tacks. List Price $6.00

Write for special offer to readers of this magazine.

STAR AUTOMATIC TACKERS

The Best Way to Tack Things

Used in industrial production work. Tack upholstery, wire screens, shades on rollers, dozens of other uses. Easy to operate — just squeeze the handle. Hold material in place with one hand, tack it with the other. Tack within 1/16" of an edge and in close quarters where you can't swing a hammer.

STAR Model S122P Stapler

A stapler and light tacker combined. Handy — fits in pocket. Squeeze it to staple papers — Holds 105 Standard Staples.

USED AS A TACKER

Swing the base down and around and it becomes a light duty tacker. Fine for tacking up charts, pictures and papers on walls, drawings on drawing boards. List Price $1.90

Write for special offer to readers of this magazine. Send for catalog of the Star line of tackers and paper fasteners.

★ Star PAPER Fastener Co.

NORWALK Dept. AE CONNECTICUT

★ ★ ★ ★ ★ ★ ★ ★ ★

GLUES for WOOD PLANE ASSEMBLY

• Teach your students actual industry methods with glues that are meeting Uncle Sam's toughest requirements for wood aircraft assembly.

Let us send you complete information on glues to meet latest Army, Navy and prime contractors' specifications.

CASCAMITE Powdered Resin Glue. Mixes instantly in cold water. No waiting. Makes waterproof, stainless joints.

CASCO Powdered Casein Glue. Cold water mix. Makes strong bonds with moderate pressure, even on beginners' imperfect work. Water-resistant.

Coupon for free project plans in every 25 cent or larger can.

FREE TEACHING AIDS

CASEIN COMPANY OF AMERICA, INC., Dept. IA—342
350 Madison Avenue, New York, N. Y.

Please send me Chart and Technical Bulletin on Wood Glues for Aircraft Manufacture.

Name.....

School.....

City.....

(Please attach school letterhead)

Detroit Public Library

Be Sure Your Employees Give Correct FIRST AID —Show Them How

With SVE SLIDEFILMS

Each S.V.E. slidefilm on First Aid consists of a strip of 35 mm. film with a series of 23 or more pictures of the size shown above. They can be projected life -size by any standard 35 mm. slidefilm projector. S.V.E. projectors are available on priority for those who need them for defense training programs.

Everyone in your plant should know the fundamentals of first aid, not merely for use in the event of air raids but for the industrial accidents which occur. The wrong kind of help can do more harm than good. The *right* methods can be quickly taught with S.V.E. slidefilms on First Aid. They cover *bandaging, wounds, control of bleeding, fractures, artificial respiration,* and *transportation of the injured.* These films can be shown by any standard 35 mm. slidefilm projector. Write for details!

Society for Visual Education, Inc.
Dept. 3-I.A.V., 100 E. Ohio St., Chicago, Ill.

Announcing

5 Wiley Books for Your

PRE-INDUCTION TRAINING COURSES

We take pleasure in announcing these five books that will prove valuable to those high schools which are introducing pre-induction courses into their curriculum. All books are written by outstanding men in their respective fields and are based on outlines prepared by the United States Office of Education with the cooperation of the War Department.

PRE-SERVICE COURSE IN SHOP PRACTICE
William J. Kennedy $1.52

PRE-SERVICE COURSE IN ELECTRICITY
William C. Shea $1.52

PRE-SERVICE COURSE IN AUTOMOTIVE MECHANICS
James V. Frost $1.96

PRE-SERVICE COURSE IN MACHINE SCIENCE
Samuel Lebowitz (Ready in March)

PRE-SERVICE COURSE IN RADIO
Vin Zeluff and John Painting (Ready in April)

Important— A teacher's manual for each book will be available shortly.

Send for your examination copies today.

JOHN WILEY & SONS, Inc.
440 Fourth Avenue New York, N. Y.

(Continued from page 70A)

fcr junior engineers in the mechanical, electrical, and aeronautical fields. Their need is very urgent.

Openings are available for immediate appointment at $2,400 per annum. Graduate engineers with no experience as well as those physically handicapped may qualify.

For further information, get in touch with the Recruiting Section, Seventh U. S. Civil Service Region, Room 1107, New Post Office Building, Chicago, Ill.

♦ The Quartermaster Corps of the War Department is in urgent need of eligible applicants to fill inspectorship positions. These employment opportunities are open to men 35 years of age and over who are not liable to early induction into the armed forces by reason of high classifications under the Selective Service Act, or who are not presently deferred because of corrective physical condition or dependency circumstances such as would justify the reasonable assumption that they may soon be reclassified and inducted. No one *now* engaged in war work will be considered unless the position for which they are applying calls for the use of higher skills than they are *now* using in their present employment.

Applicants must have at least four years of inspecting or testing plywood products with shop experience — or — *substitution* experience and training as determined by the appointing officer as adequate for proper performance of duties. Ability to read blueprints is a fundamental requirement.

Duties will consist of inspecting plywood products at contractors' plants for compliance with government specifications, maintaining records of production, originating receiving reports and making shipments on government bills of lading.

Applicants must possess ability and personality to deal successfully with military leaders, enlisted men, and officials of the contracting firms. Base pay is $2,000 per year. The work requires considerable traveling with allowance of per diem plus transportation. Appointments generally will be for the duration of the war and in no case will extend more than six months beyond the war.

File applications with P. J. Martin, representative, U. S. Civil Service Commission, Room 1107, New Post Office Building, Chicago, Ill. — Telephone: Wabash 9207.

♦ Opportunity to go to college at government expense, and aid in the war effort at the same time, is offered to high school graduates with courses in mathematics, physics, or chemistry and some college training or practical experience in the physical sciences.

Qualified applicants for positions as under engineer trainee in radio research work will be paid at the rate of $1,440 a year plus overtime during a 24-week training period at the University of Illinois. Pay will rise to $1,620 a year plus overtime upon satisfactory completion of the training period. The place of duty will be Dayton, Ohio.

Further information may be obtained from the Seventh U. S. Civil Service Region, New Post Office Building, Chicago, Ill.

♦ Draftsmen in all fields are sought by the United States Civil Service Commission for work in engineering drafting. Persons with drafting in fields as remote as commercial art or interior decorating are urged to apply to the Commission. Positions in federal agencies pay from $1,440 to $2,600 a year entrance salaries, not including payment for authorized overtime.

To qualify for a federal drafting position, persons must have at least 6 months of drafting experience, or appropriate training in drafting in high school, resident drafting schools, or college. Students enrolled in regular or war-training drafting courses may apply.

Draftsmen are needed in Washington, D. C., in all parts of the United States, and abroad. No written test is required. There are no age limits. Applications are not desired from persons already utilizing their highest skills in war work. Applications for drafting positions must be sent to the Commission's Washington, D. C., office, and will be accepted until the needs of the service are met.

♦ The Spare Parts Branch of the U. S. Army Engineer Corps, located in Columbus, Ohio, Quartermaster Depot, has many critical vacancies to be filled by technically trained personnel.

Especially urgent is the need for qualified personnel to staff vacancies in the electric accounting-machines group, including chief of section, chief shift supervisor, assistant shift supervisor, technical supervisor, head tabulating equipment operator, supervisor and assistant supervisor of the coding and editing staff. Salaries range from $1,800 to $2,900 per year.

Lieutenant James F. Harrison of the Columbus Quartermaster Depot requested qualified applicants to communicate with the Seventh United States Civil Service Regional Office, Room 1107, New Post Office Building, Chicago, Ill.

♦ The commandant of the Navy Yard, at Mare Island, Calif., has issued an urgent request for many skilled electricians whose services are needed immediately for the completion of essential repairs and replacements on battle damaged ships and other naval vessels critically needed in the Pacific Fleet.

The Navy Department will pay the cost of transportation and subsistence from Chicago to Vallejo, Calif., for qualified personnel to staff these very vital vacancies.

Experienced boilermakers, coppersmiths, instrument makers, machinists, sheet-metal workers, and ship fitters are required. Wages from $1.10 to

(Continued on page 89A)

Instructors and Students

approve

BERNARD
Aviation Shears
for Sheet Metal Cutting

Students like the way they can cut intricate patterns accurately and easily. The tough keen alloy steel blades are shaped to cut all curves and straight work. Bernard famous compound leverage multiplies manual power, making cuts with little effort.

Instructors of classes in defense work are especially invited to investigate this tool.

Write for catalog of

BERNARD TOOLS

PLIERS • PUNCHES • PRESSES
AVIATION & TINNERS SHEARS
NIPPERS & CUTTERS

They give

"More POWER to You"

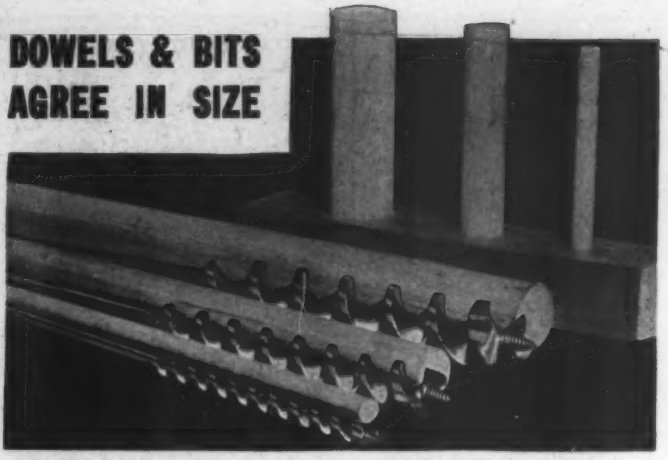
Compound Leverage
Parallel Action
Open Throat

THE WM. SCHOLLHORN CO.

School Supply Division — New Haven, Conn.

Exclusive Manufacturers of Bernard Parallel Action Tools.

DOWELS & BITS AGREE IN SIZE



Accurate Tools Make Teaching Easier

The sizes marked on Russell Jennings Auger bits *mean what they say!* In the school room this saves time and explanations, speeds up the period. Other reasons why it's a joy to work with these bits: the screw is exactly in the center — the lips and spurs are hand-sharpened — the chip clearance and body taper are correct — the steel used insures long edge-life. Russell Jennings Auger Bits are made in a full range of sizes and types. Why not *standardize* on them?

Russell Jennings
AUGER BITS

THE RUSSELL JENNINGS MFG. CO., CHESTER, CONN.

It's Easier To Learn With

GOOD SOLDERING FLUXES

The teaching of good soldering and tinning practice is more easily and satisfactorily performed with quality soldering products. They make it possible to produce stronger, neater unions in less time—with less trouble.

Rubyfluid Soldering and Tinning Fluxes are fast acting and easy to use. They quickly and properly condition the metal so that the solder holds fast. They give off no objectionable or harmful fumes. Students will respond more quickly to practices with this widely known and accepted product. Available in paste or liquid form.

For work with stainless steel, use RUBY'S Stainless Steel Flux — perfected for that metal.

Place a trial order today. Write your requirements to—

RUBY CHEMICAL CO.
77 McDowell St. Columbus, Ohio

Rubyfluid

On the **BEAM** **2 WEEKS DELIVERY** *on*

Johnson
Furnaces

JOHNSON No. 130A for Heat-Treating High Speed Steel

A Johnson furnace noted for speed and accuracy. Counter-balanced door opens upward, allowing tools to be put in or removed without fully opening furnace door, — thus preventing temperature drops. Carbofrax hearth and ¼ H.P. blower. Lined with insulating refractory. Available with 4 or 6 burners, for temperatures from 1400° to 2400° F. Firebox 7¼" high, 13" wide, 16½" long. 4-burner job illustrated $295. Complete with motor and blower. 6-burner job, $325. Complete with motor and blower. Prices F.O.B. Factory.

FREE

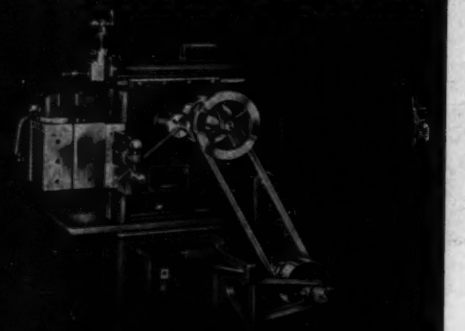
Send for your copy of the Free Johnson Catalog

SALES OFFICES:
Bourse Bldg., Philadelphia
120 Liberty St., New York City
C. B. Babcock Co., 475 11th St., San Francisco

JOHNSON GAS APPLIANCE CO.
586 E Ave. NW., Cedar Rapids, Iowa

RHODES

7" HORIZONTAL SHAPER
3½" VERTICAL SLOTTER



Convertible

TO A SHAPER OR SLOTTER IN 15 MINUTES!

RHODES MFG. CO., Waltham, Mass.

BURRILL'S

Paramount Band Saws

Your students should be provided with *BAND SAW BLADES* which have been adopted as being able to stand the stiff requirements of War Production Plants.

Accurately made Band Saws of extreme toughness enables more work to be produced in less man hours.

All sizes are carried in stock for prompt shipment.

Exclusive Band Saw Manufacturers.

PARAMOUNT SWEDISH BANDS
ACCURATELY SPACED TEETH
NO CRUSHED POINTS - GUARANTEED

BURRILL SAW & TOOL WORKS
ILION, N. Y.

Highest Standard of Quality and Grade LUMBER

We have made a specialty of serving schools with their lumber needs. More than 50 years of experience in supplying lumber to school shops is your assurance that you will get quality lumber at the right price. Sixty-five percent of our lumber stock is under shed which means lumber that can be used immediately upon delivery.

Write us for quotations on your entire requirements. We are sure you will be interested in our prices and service.

THE TEGGE LUMBER CO.
1500 W. Bruce Street Milwaukee, Wis.

Progressive

TEACHING INCLUDES LIQUID HIDE GLUE

It modernizes your students' training in the same way the motion picture and radio fit into the present-day educational scheme. Franklin Liquid Hide Glue needs no mixing, heating or preparation of any kind. Eliminates chilled joints. It's the glue preferred by the woodworking industry. Write on school letterhead for free sample.

The FRANKLIN GLUE CO.
Columbus, Ohio

(Continued from page 86A)

$1.20 per hour are paid for a forty-hour work week with overtime on the basis of time and one half for all authorized work over forty hours each week. The average work week is 48 hours. If you are doing war work of equal skill do not apply.

Qualified applicants are requested to communicate with the Seventh United States Regional Office, Room 1107, New Post Office Building, Chicago.

♦ With farm machinery difficult and sometimes impossible to get, thousands of young North Carolina farm boys are taking special courses in high schools to learn how to take care of and to repair farm machinery on hand. Taught in the regular agricultural vocational classes, the course is developing proficient young agricultural mechanics who can do everything from building a wagon to repairing and turning back into use a long-discarded plow.

Started in 1917 with classes in 21 schools in North Carolina, there are now 489 schools in which there are classes with 28,129 students. They are required to carry on some sort of supervised activity and keep a record of results. These activities include the establishment of repair shops on the farm, where farm machinery can be repaired on rainy days, the laying of water lines for the house, and, in fact, everything that has to do with the operation of a farm.

♦ Motion pictures are playing an increasingly important job in this war — in training our soldiers and sailors, in teaching the skills of machine shops and assembly lines, in bringing to the American people essential war information. A complete list of these films, produced by the United States Government, is now available in a new OWI publication, "A List of U. S. War Information Films."

The catalog lists some 200 films, most of them 16mm. sound pictures, which are available to interested American audiences through OWI, the Army and Navy, Office of Education, and other government agencies.

All the wartime films of the U. S. Government — except the combat training films of the Army and Navy — are listed in this catalog. The films of each agency, war films for war use, are described briefly, and the *where* and *how* they may be obtained are explained. For copies of "A List of U. S. War Information Films," write the Bureau of Motion Pictures, Office of War Information, Washington, D. C.

♦ War workers at the Westinghouse Electric and Manufacturing Company are smashing production records with the aid of music. Favorite recordings make the work of employees flow smoothly at the East Pittsburgh Works where Westinghouse has installed record players and amplifying systems in five divisions manufacturing motors, safety switches, and small circuit breakers.

♦ Dr. Royal B. Farnum, executive vice-president of Rhode Island School of Design, announces that with the opening of the second semester on February 1 the school will operate on a year-round basis and will utilize its facilities for the war effort in every possible way. Therefore, students who have successfully completed high school and meet the entrance requirements will be enrolled in a new class at this time.

♦ Since the opening of school in September, the department of publishing and printing of the Rochester Athenaeum and Mechanics Institute of Rochester, N. Y., is carrying on a wartime program which permits students to work in war industries and still continue their work at school. School schedules are so arranged for the individual student that they will not interfere with their war service work.

♦ Plans for the seventh annual essay contest have been worked out by the National Graphic Arts Education Association and its cosponsor, the International Printing Ink Division of the Interchemical Corporation. The general subject for the contest is: "Printing and the Economic Freedom of the Americas." The subtitles will be announced in the printed booklet on rules and regulations which will be mailed to schools of printing in the near future. The same general rules and prizes will prevail as in former years for students in the printing schools of the United States and Canada. Plans are going ahead, too, for the Latin American phase of the contest, which will probably be scheduled later in the year than the North American contest.

♦ The largest high school and junior college class in the world — composed of 20,000 students — regularly gathers around classroom radios in Iowa, Illinois, and Missouri, to hear nationally known aviation authorities explain how the airplane in the postwar period will change the living habits and standards of most of the human beings of the globe.

The chapel of the century-old Iowa Wesleyan College here is the scene of this unique experiment, a radio extension course in air transportation to prepare students for job opportunities in the coming flying age. Widely known leaders in aviation serve as teachers for a day for students enrolled in aviation courses in 120 high schools and junior colleges in the three states.

♦ Shop teachers in New York City's schools henceforth will be required to make a daily inspection of children's clothing to see that no loose parts of their apparel can be caught in a machine and become the cause of an accident, under instructions sent to the school by Superintendent of Schools John E. Wade.

At the same time, Dr. Wade ordered each shop teacher to formulate detailed safety regulations applying to the conditions existing in his shop and to conduct frequent written examinations on the subject of shop safety. The examination papers written by the pupils are to be dated and kept on file in the schools.

THESE LITTLE THINGS ARE WINNING THIS WAR

American Shells, plenty of them, are thundering and screaming the American answer to the treachery of Pearl Harbor. American Trucks, many makes of them, are seeing to it that these shells get to the battle fronts all over the world, on time. American Tools, like the K-D Tools shown here, are keeping these trucks fit and fast, and hustling to feed the guns. *These little things are winning this war!* K-D Manufacturing Company, Lancaster, Penna., and Hamilton, Ontario.

K-D TOOLS

TOP, K-D 600 Valve Lifter, adjustable, tempered jaws.

CENTER, K-D 900 Hi-Offset Lifter, ideal for use under fenders. Auxiliary jaws shown ready for use.

RIGHT, K-D 115 Ignition Point Adjusting Tool, does the job right in the distributors.

K-D TOOLS are still available for repairing essential cars and trucks. See your Jobber or write the factory.

K-D TOOLS

The Hustlers for Your Toolbox!

JUST OUT **NEW ALLIED 1943 BUYING GUIDE**

FREE—SEND FOR IT NOW!

EVERYTHING YOU NEED IN RADIO AND ELECTRONICS FOR WAR TRAINING

Allied's Educational Division has helped hundreds of military and civilian schools plan and carry out their training projects. The new, FREE Allied 1943 Buying Guide places everything in Radio and Electronics at your fingertips... books, diagrams, kits, test equipment—over 10,000 items to meet every Radio Training need! Write our Educational Division.

• USE THESE VALUABLE NEW ALLIED TRAINING AIDS •

RADIO FORMULAS and DATA BOOK
No. 37-752
Pocket size Radio Manual
.....10c

RADIO BUILDERS HANDBOOK
No. 37-750
Simplified theory and building projects 10c

SIMPLIFIED RADIO SERVICING
No. 37-755
Short cuts in trouble-shooting and repairs
.....10c

*Write for Quantity Quotations

ALLIED RADIO CORP.
833 W. Jackson Blvd., Dept. 41-C-3, Chicago

·ALLIED RADIO·

WOODWORKING TOOLS HARDWARE and SUPPLIES

For School Shop Use

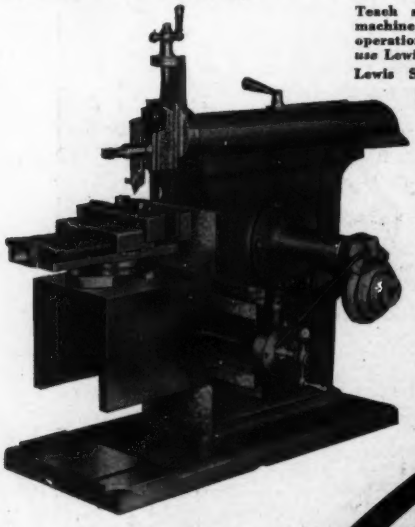
Since 1889, we have served the School Shops of the country with tools, hardware, and supplies. We can still supply many items needed in your shop work. However, some tools and materials are on the critical list.

Write for our catalog and tell us your needs. We will gladly supply whatever materials and tools we still have available. Be sure and include highest priority rating possible with each order.

Lussky, White & Coolidge, Inc.
65-71 W. Lake St. Dept. C-3 Chicago, Illinois

GIVE YOUR TRAINING CLASSES *PRACTICAL* WARTIME PROJECTS!

LEWIS Castings . . . Parts . . . Blueprints



Teach students the fundamentals of machine tool design, construction and operation by having them *build* and *use* Lewis Tools!

Lewis Shapers, Mills, Drill Presses, Band Saws, Vises and over a dozen other tools are supplied as rough or semi-finished castings, with all necessary materials and construction blueprints. On the semi-finished units all major machining is accurately finished—completing the tool requires only lathe, drill press and hand finishing operations.

Lewis projects are sturdy, soundly designed, shop-tested machine tools—not toys—that are in daily use on hundreds of war production jobs. The completed tools become valuable, much needed additions to your present war training equipment . . . yet the cost is exceedingly low.

NEW LEWIS CATALOG — sent free—gives full details and ordering data on complete Lewis Line. *Send for your copy today!*

Lewis MACHINE TOOL CO.

P. O. Box 116, Station A, Dept. X-25 — Los Angeles, California

Save Time and Labor

Keep the tools sharp

PLURALITY OILSTONE TOOL GRINDER

THE most convenient, serviceable and efficient tool sharpening machine ever made.

This Tool Grinder has been carefully designed to combine many new advantages with the essential features of former models. It combines five basic units in one machine: *coarse oilstone wheel, fine oilstone wheel, grinding cone, leather stropping wheel, emery wheel,* and all accessible from two adjacent sides.

It is motor driven, ball bearing throughout, and every unit is thoroughly guarded.

Write for full descriptive bulletin.

MUMMERT-DIXON CO.
HANOVER, PA.
Originators and Pioneer Manufacturers of Oilstone Tool Grinders

Directory of Manufacturers' Products

This directory is published as a convenient guide to sources of supply covering the products of manufacturers carrying specification data in the ANNUAL NUMBER. For alphabetical index of manufacturers' advertising see page 97A. To obtain products not included in this directory, quotations or additional information to help you make up your specifications, lists of equipment, etc., address Industrial-Arts Service Division.

CHAIRS, FOLDING

CHARGERS, BATTERY
General Electric Co.
Weidenhoff, Inc., Joseph

CHASES
American Type Founders Sales Corp.

CHASING TOOLS
Dixon, Inc., Wm.
Metal Crafts Supply Co.

CHISELS, Cape, Cold, Grooving
Atlas Press Co.
Cincinnati Tool Co.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

CHISELS, FRAMING, MORTISE
Millers Falls Co.
Stanley Tools

CHISELS, Metal Cutting and Wood Carving
Atlas Press Co.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

CHUCKS, COMBINATION
Atlas Press Co.
South Bend Lathe Works

CHUCKS, DRILL
Atlas Press Co.
Lussky, White & Coolidge, Inc.
South Bend Lathe Works
Walker-Turner Co., Inc.

CHUCKS, INDEPENDENT, Universal Combination
Atlas Press Co.
Boice-Crane Co.
South Bend Lathe Works
Walker-Turner Co., Inc.

CIRCULAR-SAW BENCHES
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

CLAMPS
Adjustable Clamp Co.
Armstrong Bros. Tool Co.
Atkins & Co., E. C.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
Starrett Co., L. S.
Williams & Co., J. H.

CLAMPS, ADJUSTABLE
Adjustable Clamp Co.
Cincinnati Tool Co.
Lussky, White & Coolidge, Inc.

CLAMPS, BAR
Adjustable Clamp Co.
Cincinnati Tool Co.
Lussky, White & Coolidge, Inc.
Oliver Machinery Co.

CLAMPS, CARRIAGE, SCREW
Adjustable Clamp Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
Oliver Machinery Co.

CLAY, MODELING
American Art Clay Co.
Western Stoneware Co.

COMBINATION SQUARES
Starrett Co., L. S.

COMPOSING STICKS
American Type Founders Sales Corp.

CONDUIT FITTINGS
General Electric Co.

CONDUITS
General Electric Co.

CONDUITS, FLEXIBLE
General Electric Co.

CONTROLLERS, ELECTRIC
General Electric Co.

COPING SAW BLADES
Atkins & Co., E. C.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.

COPING SAWS
Atkins & Co., E. C.

COPING SAWS, Power
Crescent Machine Co.
Delta Mfg. Co.
Walker-Turner Co., Inc.

COUNTERSINKS
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

CURVES, IRREGULAR
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

CUT-OFF SAWS
Atkins & Co., E. C.
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.

CUTTER HEADS
Atkins & Co., E. C.
Delta Mfg. Co.
Huther Bros. Saw Mfg. Co.
Morse Twist Drill Co.
Williams & Co., J. H.
Yates-American Machine Co.

CYLINDER PRINTING PRESS
American Type Founders Sales Corp.

DADO HEADS
Atkins & Co., E. C.
Boice-Crane Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Walker-Turner Co., Inc.
Yates-American Machine Co.

DISTRIBUTION TRANSFORMERS
General Electric Co.

DOWEL POINTERS
Lussky, White & Coolidge, Inc.
Stanley Tools

DOWELING JIGS
Lussky, White & Coolidge, Inc.
Stanley Tools

DRAFTING PENS
Dietzgen Co., Eugene
Gordon Co., M.
Post Company, Frederick

DRAFTING TABLES
Dietzgen Co., Eugene
Engineering Sales Co.
Post Company, Frederick
Sheldon & Co., E. H.
Weber Company, F.

DRAFTSMENS' INSTRUMENTS
Dietzgen Co., Eugene
Gordon Co., M.
Post Company, Frederick
Starrett Co., L. S.
Weber Company, F.

DRAWING OUTFITS
Dietzgen Co., Eugene
Gordon Co., M.
Post Company, Frederick
Weber Company, F.

DRAWING PAPER IN ROLLS AND SHEETS
Dietzgen Co., Eugene
Gordon Co., M.
Post Company, Frederick
Weber Company, F.

DRILL PRESSES
Atlas Press Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Crescent Machine Co.
Delta Mfg. Co.
Millers Falls Co.
Porter-Cable Machine Co.
South Bend Lathe Works
Walker-Turner Co., Inc.

DRILL STANDS, BENCH, POST, PEDESTAL
Armstrong Bros. Tool Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Brodhead-Garrett Co.
Millers Falls Co.
Stanley Electric Tools

DRILLING MACHINES, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Electric Tools
Stanley Tools

DRILLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Morse Twist Drill Co.

DRILLS, BENCH AND FLOOR, HIGH SPEED
Atlas Press Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Delta Mfg. Co.
Millers Falls Co.
Walker-Turner Co.

DRILLS, BREAST
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

DRILLS, HAND
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
North Brothers Mfg.Co.

DUPLICATORS
Ditto, Inc.

DYNOMETERS, ELECTRIC
General Electric Co.

ELECTRIC WELDING EQUIPMENT & SUPPLIES
Eisler Engineering Co.
General Electric Co.
Hobart Brothers
Lincoln Electric Co.
Marquette Manufacturing Co.
Union Carbide & Carbon Corp.

ELECTRIC EQUIPMENT, WIRE & SUPPLIES
Reading Electric Co., Inc.

ELECTRIC GENERATORS
General Electric Co.

ELECTRIC MOTORS
Atlas Press Co.
Baldor Electric Co.
Boice-Crane Co.
General Electric Co.
Walker-Turner Co., Inc.

ELECTRIC SOLDERING IRONS
Lussky, White & Coolidge, Inc.
Stanley Tools

ELECTRICAL INSTRUMENTS
General Electric Co.
Weston Electric Instrument Corp.

ELECTROTYPES
Badger Electrotype Co.

EMERY CLOTH
Norton Abrasives
Behr-Manning Corp.

EMERY POWDER

ENGRAVERS' TOOLS AND SUPPLIES
Chicago Wheel & Mfg. Co.
Metal Crafts Supply Co.

ENVELOPES, Report Card, Commercial, Etc.
Western States Envelope Co.

ENVELOPES, Baronial, Catalog, Clasp, Commercial, Window
Western States Envelope Co.

FASTENERS—Staple
Star Paper Fastener Co.

FEEDERS, Automatic (Printing)
American Type Founders Sales Corp.

FILES AND RASPS
Atkins & Co., E. C.
Delta Files
Disston & Sons, Inc., Henry
Heller Bros. Company
Lussky, White & Coolidge, Inc.
Nicholson File Co.
Plumb Inc., Fayette R.

FILING CASES
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

FILING MACHINES
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Foley Mfg. Co.

ABRASIVE PAPER & CLOTH
Behr-Manning Corp.
Carborundum Co., The

ADJUSTABLE CURVE RULERS
Dietzgen Co., Eugene
Post Company, Frederick

AIR COMPRESSORS
DeVilbiss Co.

AIR CONTROL UNITS
DeVilbiss Co.

AIR FILTERS
DeVilbiss Co.

AIR REGULATING VALVES
DeVilbiss Co.

AMMETERS
General Electric Co.
Weston Electric Instrument Corp.

ANVILS
Atlas Press Co.
Cincinnati Tool Co.

ANVIL TOOLS
Stanley Tools

ARBOR PRESSES
Atlas Press Co.

ARC-WELDING SETS & EQUIP.
Eisler Engineering Co.
General Electric Co.
Hobart Bros. Co.
Marquette Manufacturing Co.
Union Carbide & Carbon Corp.

ARCHERY MATERIALS
Whiffen Co., L. C.

ART METAL TOOLS
Metal Crafts Supply Co.

AUTOMOTIVE TEST EQUIPMENT
Weidenhoff, Inc., Joseph

AUTOMOTIVE TOOLS AND EQUIPMENT
Armstrong Brothers Tool Co.
Black & Decker Mfg. Co.
K-D Manufacturing Co.
Millers Falls Co.
Snap-On Tools Corp
Stanley Tools
Weidenhoff, Inc., Joseph

AWLS, TINNERS
Millers Falls Co.
Stanley Tools

BABBITT FURNACES
American Gas Furnace Co.
Chicago Flexible Shaft Co.
Johnson Gas Appliance Co.

BAND SAW BLADES
Atkins & Co., E. C.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Walker-Turner Co., Inc.

BAND SAW BRAZERS, Electric
Atkins & Co., E. C.
Oliver Machinery Co.

BAND SAWS
Atkins & Co., E. C.
Boice Crane Co.
Brodhead-Garrett Co.
Burrill Saw & Tool Works
Crescent Machine Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Lewis Machine Tool Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

BAND SAWS, METALCUTTING
Starrett Co., L. S.

BAND SAWS, PORTABLE
Boice Crane Co.
Delta Mfg. Co
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.

BAND SAW SETS
Atkins & Co., E. C.

BAR IRON

BATTERY CHARGERS
General Electric Co.
Weidenhoff, Inc., Joseph

BENCH FURNACES
American Gas Furnace Co.
Chicago Flexible Shaft Co.
Johnson Gas Appliance Co.

BENCH VISES
Abernathy Vise & Tool Co.
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co
Lewis Machine Tool Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Morgan Vise Co.
Oliver Machinery Co.

BENCHES

Jewelers' and Metal Workers'
Sheldon & Co., E. H.

BENCHES, MANUAL TRAINING
Brodhead-Garrett Co.
Lussky, White & Coolidge, Inc.
Sheldon & Co., E. H.

BIT HOLDERS, EXTENSION
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools

BITS, AUGER
Millers Falls Co.
Russell-Jennings Mfg. Co.
Stanley Tools

BITS, SCREW DRIVERS
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools

BLACKBOARD DRAWING SETS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Co., F.

BLOWERS, FORGE
American Gas Furnace Co.
Chicago Flexible Shaft Co.

BLOWPIPES, Brazing, Jewelers'
American Gas Furnace Co.

BLOWTORCHES
Lussky, White & Coolidge, Inc.
Turner Brass Works

BLUE-PRINT CABINETS

BLUE-PRINT PAPER
Dietzgen Co., Eugene
Pease Co., The C. F.
Post Company, Frederick
Victoray Corporation

BLUE-PRINTING MACHINES, ELECTRIC
Dietzgen Co., Eugene
Pease Co., The C. F.
Victoray Corporation

BOARDS, DRAWING
Dietzgen Co., Eugene
Engineering Sales Co.
Post Company, Frederick
Weber Co., F.

BOOKS
Allied Radio Corp
American Technical Society
Heath & Company, D. C
International Textbook Co.
McGraw-Hill Book Co.
Bruce Publishing Company
McKnight & McKnight
Manual Arts Press
Motor
National Audio Visual-Council, Inc.
Sliver Burdett Company
Wiley & Sons, Inc., John

BOOKBINDING EQUIPMENT AND SUPPLIES
Pratt, G. A.

BORERS, WOOD
Delta Mfg. Co.
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.

BORING BARS
Armstrong Bros. Tool Co.
Atlas Press Co.
South Bend Lathe Works
Williams & Co., J. H.

BORING TOOLS
Armstrong Bros. Tool Co.
Atlas Press Co.
Lussky, White & Coolidge, Inc.

BOW COMPASSES, DIVIDERS, PENS, PENCILS
Dietzgen Co., Eugene
Dixon Crucible Co., Joseph
Post Company, Frederick
Weber Co., F.

BRACES
Millers Falls Co.
North Brothers Mfg. Co.
Russell-Jennings Mfg. Co.
Stanley Tools

BRAD AWLS
Millers Falls Co.
Stanley Tools

BRASS FURNACES, GAS
American Gas Furnace Co.
Chicago Flexible Shaft Co.
Johnson Gas Appliance Co.

BRASS TYPE
American Type Founders Sales Corp.

BRAYERS
American Type Founders Sales Corp.

BRAZING TORCHES
American Gas Furnace Co.
Atkins & Co., E. C.

BRISTOL BOARD
Dietzgen Co., Eugene
Post Company, Frederick
Weber Co., F.

BRUSHES, ARTISTS'
Dietzgen Co., Eugene
Post Company, Frederick

BRUSHES, CIRCULAR, BRISTLE AND WIRE (All Kinds)
Atlas Press Co.
Black & Decker Mfg. Co.

BRUSH MAKING MATERIALS
Whiting, E. B. & A. C.

BUFFS, POLISHING

BUFFERS, BENCH, PEDESTAL
Stanley Electric Tools

BURNERS, Bunsen or Laboratory
Johnson Gas Appliance Co.

CABINET HARDWARE
Brodhead-Garrett Co.
Lussky, White & Coolidge, Inc.
Stanley Works

CABINETS, Cut and Electro
American Type Founders Sales Corp.

CABINETS, Furniture, Galleys, Ink, Type, and Rollers
American Type Founders Sales Corp.

CALIPERS
Lussky, White & Coolidge, Inc.
Starrett Co., L. S.

CARVED WOOD MOLDINGS
Craftsman Wood Service Co.

CARVING TOOLS, for Wood and Linoleum
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.

CASTING OUTFIT

Sand, Jewelers'

CEMENTS
Gill Products Co., Inc.
Testor Chemical Company

CENTER LATHE
Atlas Press Co.
LeBlond Machine Tool Co.
South Bend Lathe Works

CERAMICS
American Art Clay Co.
Brodhead-Garrett Co.
Ceramic Atelier Co.
Western Stoneware Co.

FILMS, INDUST. TRAINING
Brandon Films
National Audio Visual Council, Inc.
Society for Visual Education, Inc.

FILMS, TEACHING, ETC.
Brandon Films
National Audio Visual Council, Inc.
Society for Visual Education, Inc.

FINISHING MATERIALS
General Finishes Sales & Service Co.
Lussky, White & Coolidge, Inc.

FIRE BRICK AND CEMENT
Chicago Flexible Shaft Co.

FIRE CLAY
Chicago Flexible Shaft Co

FLASKS
Sterling Wheelbarrow Co.

FLEXIBLE SHAFT AND MOTOR OUTFITS
Walker-Turner Co., Inc.

FLEXIBLE STEEL TAPE RULES
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

FLEXIBLE TUBING AND CONDUITS
General Electric Co.

FLINT PAPER
Behr-Manning Corp.
Carborundum Co., The
Lussky, White & Coolidge, Inc.
Norton Abrasive (Behr-Manning)

FLOOR SANDERS
Porter-Cable Machine Co.

FLUX, SOLDERING
Kester Solder Co.
Ruby Chemical Company

FOLDING RULES
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

FORGE TOOLS
Stanley Tools

FORGES, Annealing & Melting
American Gas Furnace Co.
Chicago Flexible Shaft Co.

FORGES, GAS
American Gas Furnace Co.
Chicago Flexible Shaft Co.

FOUNDRY EQUIPMENT & SUPPLIES
Brodhead-Garrett Co.
Sterling Wheelbarrow Co.

FREQUENCY METERS Portable and Switchboard
Weston Electric Instrument Co.

FURNACE LININGS
Behr-Manning Corp.
Carborundum Co., The

FURNACES, Annealing, Case-Hardening, Heat Treating, Metal Melting, Soldering, Tempering
American Gas Furnace Co.
Chicago Flexible Shaft Co.

General Electric Co.
Johnson Gas Appliance Co.

FURNACES, FORGING
American Gas Furnace Co.
Chicago Flexible Shaft Co.

FURNITURE TRIM
Lussky, White & Coolidge, Inc.

FUSES, STANDARD
General Electric Co.

GALVANOMETERS
General Electric Co.
Weston Electric Instrument Corp.

GARNET PAPER AND CLOTH
Behr-Manning Corp.
Carborundum Co., The
Lussky, White & Coolidge, Inc.
Norton Abrasive (Behr-Manning)

GAS-WELDING Equip. & Supplies
Air Reduction Sales Corp.
Union Carbide & Carbon Corp.

GAUGES, BIT
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Williams & Co., J. H.

GAUGES, CABINET, RULE AND SQUARE
Stanley Tools

GAUGES, CALIPER
Atlas Press Co.
Starrett Co., L. S.

GAUGES, MARKING
Atlas Press Co.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

GAUGES, THICKNESS AND THREAD
Atlas Press Co.
Starrett Co., L. S.

GENERATOR TEST BENCHES
General Electric Co.
Weidenhoff, Inc., Joseph

GLAZING TOOLS
Smith, Inc., Landon P.

GLUE
Casein Company of America
Franklin Glue Company
Gill Products Co., Inc.
Higgins Ink Co., Inc.
LePage's, Inc.
Lussky, White & Coolidge, Inc.
Monite Waterproof Glue Co.

GLUE POTS, ELECTRIC
Black & Decker Mfg. Co.
General Electric Co.
Lussky, White & Coolidge, Inc.
Oliver Machinery Co.
Russell Electric Co.
Sta-Warm Elec. Co.
Wallace & Co., J. D.

GOUGES
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

GRINDERS AND BUFFERS, PORTABLE ELECTRIC
Baldor Electric Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Chicago Wheel & Mfg. Co.
Delta Mfg. Co
Dumore Co., The
Lewis Machine Tool Co.
Lussky, White & Coolidge, Inc.
Rivett Lathe & Grinder Corp
Stanley Electric Tools

GRINDERS, BENCH
Atkins & Co., E. C.
Atlas Press Co.
Black & Decker Mfg. Co.
Boice-Crane Co.
Delta Mfg. Co.
Lussky, White & Coolidge, Inc.
Mummert-Dixon Co.
Rivett Lathe & Grinder Corp.
Stanley Electric Tools

GRINDERS, INTERNAL
Rivett Lathe & Grinder Corp.

GRINDERS, OILSTONE
Mummert-Dixon Co.
Wallace Co., J. D.

GRINDERS, PEDESTAL TYPE
Atlas Press Co.
Baldor Electric Co.
Black & Decker Mfg. Co.
Carter, B. L., Div.,
Crescent Machine Co.
Mummert-Dixon Co.
Porter-Cable Machine Co.
Delta Mfg. Co.
Stanley Electric Tools
Walker-Turner Co., Inc.

GRINDING WHEELS
Atkins & Co., E. C.
Atlas Press Co.
Black & Decker Mfg. Co.
Behr-Manning Corp.
Carborundum Co., The
Lussky, White & Coolidge, Inc.
Norton Abrasive Co. (Behr-Manning)

HACKSAW BLADES
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.

HACKSAWS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Lewis Machine Tool Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Starrett Co., L. S.

HACKSAWS, Power
Atkins & Co., E. C.
Peerless Machine Co.
Racine Machine Tool Co.

HACKSAWS, POWER BLADES
Atkins & Co., E. C.

HAMMERS
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Plumb, Inc., Fayette R.
Stanley Tools

HAMMERS, BALL-PEEN CROSS-PEEN, SLEDGE
Lussky, White & Coolidge, Inc.
Plumb, Inc., Fayette R.
Stanley Tools

HAMMERS, BLACKSMITH
Plumb, Inc., Fayette R.
Stanley Tools

HAMMERS, LEAD AND SOFT FACE
Stanley Tools

HAMMERS, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Stanley Electric Tools

HAND SAWS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.

HAND SAWS, PORTABLE ELECTRIC
Stanley Electric Tools

HAND SCREWS
Adjustable Clamp Co.
Cincinnati Tool Co.
Lussky, White & Coolidge, Inc.

HANDICRAFT SUPPLIES
Brodhead-Garrett Co.
Hammett Co., J. L.

HARDIES
Stanley Tools

HEAT-FLOW METERS
Weston Electric Instrument Corp.

HEAT-TREATING EQUIPMENT
American Gas Furnace Co.
Chicago Flexible Shaft Co.
Johnson Gas Appliance Co.

INDICATING INSTRUMENTS, ELECTRIC
General Electric Co.
Weston Electric Instrument Corp.
Weidenhoff, Inc., Joseph

INK REMOVERS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

INKS, DRAWING AND COLORED
Higgins Ink Co., Inc.
Post Company, Frederick
Weber Company, F.

INKS, PRINTING
American Type Founders Sales Corp.
Driscoll & Co., Martin

IRON & BRASS ORNAMENTS

JACKETS, SNAP, FLASK, AND MOLD
Oliver Machinery Co.

JEWELERS' TOOLS, EQUIPMENT AND SUPPLIES
Chicago Wheel & Mfg. Co.
Metal Crafts Supply Co.

JIG SAWS
Boice Crane Company
Brodhead-Garrett Co.
Crescent Machine Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Oliver Machinery Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS
Boice Crane Company
Crescent Machine Co.
Delta Mfg. Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Power King Tool Corp.
Stanley Tools
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS, BENCH
Boice Crane Company
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

JOINTERS, HAND
Atkins & Co., E. C.
Delta Mfg. Co.
Yates-American Machine Co.

KNIVES, BAND
Burrill Saw & Tool Works

KNIVES, MACHINE
Atkins & Co., E. C.
Burrill Saw & Tool Works
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfr. Co.
Woodworker's Tool Works
Yates-American Machine Co.

KNIVES, PAPER CUTTER
American Type Founders Sales Corp.
Atkins & Co., E. C.
Huther Bros. Saw Mfg. Co.

KNIVES, Sloyd, Linoleum, Leather, Stencil and Wood Carving
Lussky, White & Coolidge, Inc.
X-acto Crescent Products Co., Inc.

KNOCK-DOWN FURNITURE
Giles & Kendall Co.

KNURLS
Armstrong Bros. Tool Co.

LABORATORY STANDARD INSTRUMENTS
Weston Electric Instrument Corp.

LACQUERS
Campbell Co., M. L.

LAMPS, ALCOHOL
Lussky, White & Coolidge, Inc.

LAMPS, MINIATURE
General Electric Co.

LAPIDARY TOOLS & SUPPLIES

LATHE ATTACHMENTS
Armstrong Bros. Tool Co.
Atlas Press Co.
Dumore Co., The
Lussky, White & Coolidge, Inc.
Rivett Lathe & Grinder Corp.
South Bend Lathe Works

LATHES, Bench, Metal Working
Atlas Press Co.
Rivett Lathe & Grinder Corp.
South Bend Lathe Works

LATHES, GAP BED
Boice Crane Co.
Walker-Turner Co., Inc.

LATHES, Metal-Working
Atlas Press Co.
LeBlond Machine Tool Co., R. K.
Rivett Lathe & Grinder Corp.
Sheldon Machine Co., Inc.
South Bend Lathe Works

LATHES, SMALL PRECISION
Atlas Press Co.

LATHES, SPINNING
Atlas Press Co.
Boice Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.

LATHES, WOODWORKING
Atlas Press Co.
Boice Crane Co.
Brodhead-Garrett Co.
Crescent Machine Co.
Delta Mfg. Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

LEAD AND RULE CUTTERS
American Type Founders Sales Corp.

LEATHER
Lussky, White & Coolidge, Inc.

LEATHER, WORKING TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.
Osborn Bros.

LETTERS AND FIGURES FOR STAMPING METALS
Atlas Press Co.
Lussky, White & Coolidge, Inc.

LEVELS
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Starrett Co., L. S.

LINOLEUM AND RUBBER BLOCKS AND ENGRAVING TOOLS
American Type Founders Sales Corp.
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.

LINOLEUM, BLOCK CUTTING & PRINTING TOOLS & SUPPLIES
American Type Founders Sales Corp.
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.

LOCKERS

LOCKER-WORK BENCHES

LOOM CLAMPS
General Electric Co.

LUMBER
Brodhead-Garrett Co.
Foley Lumber Co., T. A.
Giles & Kendall Co.
Paxton Lumber Co., Frank
Tegge Lumber Co.

MACHINE KNIVES, JOINTER AND SURFACER
Atkins & Co., E. C.
Boice-Crane Co.
Crescent Machine Co.
Huther Bros. Saw Mfg. Co.
Yates-American Machine Co.

MACHINE LIGHTS
Atlas Press Co.
Boice-Crane Co.

MACHINISTS' TOOLS
Atlas Press Co.
Lufkin Rule Co.
Lussky, White & Coolidge, Inc.
Starrett Co., L. S.

MALLETS, HICKORY, RUBBER, RAWHIDE
American Type Founders Sales Corp.
Lussky, White & Coolidge, Inc.
Stanley Tools

MANUAL-TRAINING HARDWARE
Lussky, White & Coolidge, Inc.

MANUAL-TRAINING TOOLS AND SUPPLIES
Atkins & Co., E. C.
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Company
Cincinnati Tool Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Patterson Bros.
Stanley Tools
Starrett Co., L. S.

MANUAL-TRAINING VISES
Abernathy Vise & Tool Co.
Atlas Press Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Morgan Vise Co.

MEASURING INSTRUMENTS ELECTRIC
General Electric Co.
Weston Electric Instrument Corp.

MELTING POT EQUIPMENT
American Gas Furnace Co.
Chicago Flexible Shaft Co.
General Electric Co.
Johnson Gas Appliance Co.

METAL CUTTING MACHINES
Peerless Machine Co.
Racine Machine Tool Co.

METAL CRAFT TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Metal Crafts Supply Co.

METAL SHEARS, ELECTRIC
Stanley Electric Tools

METALS, SHEET
Metal Crafts Supply Co.

METRIC SCALES, FLAT
Dietzgen Co., Eugene
Post Company, Frederick

MICA
General Electric Co.

MICROMETERS
Starrett Co., L. S.

MICROFARAD METERS
Weston Electric Instrument Corp.

MILLING ATTACHMENTS
Atlas Press Co.

MILLING MACHINES
Cincinnati Milling Machinery Co.
Kearney & Trecker Corp.
Kempsmith Machine Company

MIMEOGRAPHS
Dick Co., A. B.

MITER BOXES
Atkins & Co., E. C.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

MITERING MACHINES, HAND AND POWER (Printing)
American Type Founders Sales Corp.

MODEL BOAT & AIRPLANE PARTS

MODELING TOOLS
Chicago Wheel & Mfg. Co.
Western Stoneware Co.

MORTISERS
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.

MOTOR GENERATOR SETS
General Electric Co.

MOTORS, ELECTRIC
Atlas Press Co.
Boice-Crane Co.
Delta Mfg. Co.
General Electric Co.
Walker-Turner Co., Inc.

NIPPERS, Cutting, Jewelers'
Lussky, White & Coolidge, Inc.
Starrett Co., L. S.

NUMBERING MACHINES
American Type Founders Sales Corp.

OHMMETERS, PORTABLE
Weston Electric Instrument Corp.

OILSTONE TOOL GRINDER, Power
Mummert-Dixon Co.
Oliver Machinery Co.
Wallace Co., J. D.

OILSTONES
Behr-Manning Corp.
Carborundum Co., The
Lussky, White & Coolidge, Inc.
Norton Abrasive (Behr-Manning)

ORNAMENTS, Iron & Brass
Lussky, White & Coolidge, Inc.

OUTLETS, SWITCHBOXES
General Electric Co.

OXY ACETYLENE SETS & EQUIPMENT
Air Reduction Sales Corp.
Union Carbide & Carbon

OZALID PAPER
Dietzgen Co., Eugene

PAGE FRAMES
American Type Founders Sales Corp.

PAINTS AND VARNISHES
Campbell Co., M. L.
Dixon Crucible Co., Joseph
Lussky, White & Coolidge, Inc.

PAINT SPRAY GUNS
DeVilbiss Co.

PANEL BOARD ELECTRIC
General Electric Co.

PAPER, CLOTH-BACKED
Dietzgen Co., Eugene
Post Company, Frederick

PAPER CUTTERS
American Type Founders Sales Corp.

PAPER, DETAIL, RULED
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

PAPER, DRAWING AND TRACING
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.

PASTE
Higgins Ink Co., Inc.

PENCILS, PLAIN, COLORED, DRAWING, WORKING
Dietzgen Co., Eugene
Dixon Crucible Co., Jos.
Dixon's Typewriter Eldorado Pencils
Eagle Pencil Company
Eberhard Faber Pencil Co.
Lussky, White & Coolidge, Inc.
Post Company, Frederick
Weber Company, F.

PENS, INK SHADING
Dietzgen Co., Eugene
Post Company, Frederick

PENS, LETTERING
Dietzgen Co., Eugene
Post Company, Frederick

PEWTER

PHASE ANGLE METERS
Weston Electric Instrument Corp.

PICTURE FRAME TOOLS
Stanley Tools

PLANERS AND SURFACERS (WOOD)
Boice-Crane Company
Crescent Machine Co.
Wallace Co., J. D.
Yates-American Machine Co.

PLANES, HAND
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools

PLASTICS

PLASTIC WOOD
Gill Products Co., Inc.
Lussky, White & Coolidge, Inc.

PLASTIC WOOD SOLVENTS
Gill Products Co., Inc.

PLATEN PRESSES
American Type Founders Sales Corp.

PLATING SOLUTIONS

PLIERS
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Schollhorn Co., Wm.

PLIERS, Flat Nose, Round Nose, Side Cutting
Lussky, White & Coolidge, Inc.

PLUMBING FIXTURES
Bradley Washfountain Co.

PLYWOOD AND VENEER
Brodhead-Garrett Co.
Giles & Kendall Co.
Tegge Lumber Co.

POLISHING COMPOSITIONS AND POWDERS

PORCELAIN KNOBS, CLEATS, ETC.
General Electric Co.

PORTABLE METERS, INDICATING
General Electric Co.
Weston Elec. Inst. Corp.

PORTABLE WOODWORKING MACHINERY
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Tannewitz Works, The
Walker-Turner Co.
Wallace Co., J. D.
Yates-American Machine Co.

POTTERY CLAY
American Art Clay Co.
Ceramic Atelier Co.
Western Stoneware Co.

PRESSES, VENEER
Atlas Press Co.
Yates-American Machine Co.

PRINTERS' ENVELOPE SERVICE
Western States Envelope Co.

PRINTERS' ROLLERS
American Type Founders Sales Corp.

PRINTING PRESS MOTORS
General Electric Co.

PRINTING PRESSES
American Type Founders Sales Corp.
Brandtgen & Kluge, Inc.

PRINTSHOP EQUIPMENT AND SUPPLIES
American Type Founders Sales Corp.
Brandtgen & Kluge, Inc.
DeVilbiss Co.

PROJECTS

PROOF PRESSES
American Type Founders Sales Corp.

PROTRACTORS
Dietzgen Co., Eugene
Post Company, Frederick
Starrett Co., L. S.

PUBLISHERS
Allied Radio Corp.
American Technical Society
Bruce Publishing Company
Heath and Company, D. C.
Manual Arts Press
McGraw-Hill Book Co., Inc.
McKnight & McKnight
Motor
Silver Burdett Company
Wiley & Son, Inc., John

PUNCHES, CENTER, PRICK AND SOLID
Atkins & Co., E. C.
Atlas Press Co.
Cincinnati Tool Co.
Lufkin Rule Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Schollhorn Co., Wm.
Stanley Tools

RADIO TEST EQUIPMENT
Weidenhoff, Inc., Joseph
Weston Electric Instrument Corp.

RECEPTACLES, Cleat, Medium Base or Miniature
General Electric Co.

RECEPTACLES, Duplex Plate & Slug
General Electric Co.

REDUCING GLASS
Dietzgen Co., Eugene
Post Company, Frederick

"Westko Modeling Clay"

This clay is used in Schools and Art Institutions throughout the United States.

Write for prices and information

Western Stoneware Co.
Monmouth, Illinois

"HOLD-HEET" GLUE POTS
are Standard in School Shops!

They're safe, fool-proof, built "like a boiler" to take plenty of shop abuse. Automatic Thermostat controls glue temperature; no burned or spoiled glue; no water jacket troubles; no fire hazards. PLAY SAFE —teach students modern, safe gluing methods with this superior "Hold-Heet" Electric Glue Pot—used by Industry and schools everywhere!

1 qt. $14 4 qt. $24
2 qt. $17 8 qt. $36
115 or 230 Volts

RUSSELL ELECTRIC COMPANY
364 W. Huron St., Chicago, Ill.

High Grade
Printing Inks

For SCHOOL PRINT SHOPS

COVERWELL INKS FOR QUALITY PRINTING

MARTIN DRISCOLL & CO.
610 Federal St. Chicago, Ill. | Portland, Oregon | 407 E. Michigan St. Milwaukee, Wis.

POTTERY
KILNS—CLAYS—GLAZES
WRITE DEPARTMENT B FOR COMPLETE CATALOG
AMERICAN ART CLAY CO. INDIANAPOLIS

PRACTICAL SCHOOL SHOP JOINTER

H and A 6" Jointer, extra long tables, 42" overall, rabbetting type, automatic safety guard adjustable tilting fence, three knife round safety head, ball bearing boxes, made entirely of sand cast iron parts, free of die castings, ½ H.P. single phase motor, 110 volt, starter, bench type as shown.....$102.00
Cast iron floor stand mounted..... 118.00

Send for large circular.

WOODWORKERS' TOOL WORKS
224 S. Jefferson Street Chicago, Illinois

New Publications

Aircraft Handbook

By Fred H. Colvin. Leather, 784 pages, 5¾ by 8⅛ in., illustrated. Price, $5. Published by McGraw-Hill Book Co., New York, N. Y.

This is the fifth edition of this handbook. To bring the subject matter up to date required a complete rewriting of its contents.

The book is especially designed to help the ground mechanic in his efforts to "keep 'em flying."

Chip Carving

By Harris W. Moore. Paper, 46 pages, 7½ by 9½ in., illustrated. Price, $1. Published by The Manual Arts Press, Peoria, Ill.

This book presents in simple and concise terms, how chip carving is done, and what tools are used.

The illustrations chosen by the author to introduce his subject show some fine examples of primitive carving.

The book contains 22 plates of designs for interesting and useful projects tastefully ornamented by chip carving.

Fundamental Jobs in Electricity

By Perry and Schafebook. Cloth, 447 pages, 6¼ by 9⅛ in., illustrated. Price, $2.20. Published by McGraw-Hill Book Company, New York, N. Y.

This book covers nine units of electricity. These units cover the fundamentals; signal wiring communication; safety for the electrician; light and power wiring; generators, motors, and transformers; electrical refrigeration; automobile and airplane wiring; and farm electrification.

The entire subject is presented in 121 jobs.

The appendix contains a glossary of electrical terms, and suggestions for student and teacher.

Before You Fly

By Pearle T. Robinson, Frederic A. Middleton, George M. Rawlins, Jr., and Joseph W. Phillips. Cloth, 624 pages, 5¾ by 8½ in., illustrated. Price, $2. Published by Henry Holt and Company, New York, N. Y.

This book will assist the students in preinduction classes to get a good preflight idea of the airplane and how to fly. The book contains guidance material, history, and a wealth of descriptive material on the airplane, its motive power and instruments, and the things which pilots must know to be successful flyers.

OUR MEN NEED ★ BOOKS ★

SEND ALL YOU CAN SPARE

Help a man in uniform enjoy his leisure hours. Give your good books to the 1943 VICTORY BOOK CAMPAIGN. Leave them at the nearest collection center or public library.

FIRST and FINEST **HANDEE**

TOOL OF 1001 USES

Does precision work on metals, alloys, plastics, wood, horn, bone, glass, etc. Original tool of this type and the favorite today.

A WHOLE TOOLSHOP IN ONE HAND

Uses 300 accessories to grind, drill, polish, rout, cut, carve, sand, saw, sharpen, engrave. Plugs in any socket. Wt. 12 oz. 25,000 r.p.m. *$18.50* postpaid with 7 Accessories.

EVERY VOCATIONAL SCHOOL NEEDS THIS ULTRA DE LUXE SET

Strong, metal carrying case contains a DeLuxe model Handee and 45 of the most popular and most practical accessories. It's a good idea to begin with this set and then add accessories as needed.

Postpaid, *$25.00.*

ORDER on 10-DAYS MONEY-BACK TRIAL

FREE—64-page Catalog describes all Handee Products and their wide application in crafts and industry all over the world.

CHICAGO WHEEL & MFG. CO.
1101 W. Monroe Street Dept. IA Chicago, Illinois

Write for literature and prices today.

GILL PRODUCTS CO., Inc.
305 Wisconsin Tower
Milwaukee, Wisc.
168 W. 23rd St., New York City

MEND-ALL WOODFORMING PLASTIC

Ideal for School Shop Use

Mend-All Woodforming Plastic is canned wood which can be molded by hand, knife, or other tools. After hardening, can be sawed, tooled, turned, or whittled. Will not crack or split. Holds screws and nails and can be sanded, painted, stained, or varnished. Water and crack proof. Excellent for fillet work.

Other Mend-All Products

Mend-All Liquid Hide Glue
Mend-All Liquid Solvent
Mend-All Waterproof Cement

Heat Treating Furnaces and Equipment

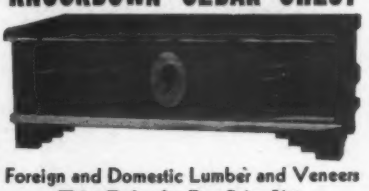
FORGES—gas fired, no smoke or dirt. Sizes from the bench type at right to large floor models.

MELTERS—for aluminum, brass, lead, gold, etc., many sizes and types.

We also supply Ovens, Salt Baths, Complete Shop Tables — Blowpipes, Burners Etc.

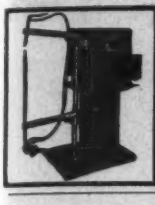
American Gas Furnace Co.
Elizabeth, N. J.

KNOCKDOWN CEDAR CHEST



Foreign and Domestic Lumber and Veneers
Write Today for Free Price List
GILES & KENDALL, CO., Decatur, Alabama

RESISTANCE BOXES, PLUG AND DIAL
Weston Electric Instrument Corp.
REVOLUTION COUNTERS
Dietzgen Co., Eugene
Post Company, Frederick
Starrett Co., L. S.
RHEOSTATS
General Electric Co.
ROUTERS
Carter Co., R. L., Div., The
Stanley Electric Tools
Stanley Tools
ROUTERS, PORTABLE AND STATIONARY
Chicago Wheel & Mfg. Co.
Stanley Electric Tools
Stanley Works
Yates-American Machine Co.
RUBBER, MOLD MAKING
RULES, WOOD, BOXWOOD AND COMBINATION
Dietzgen Co., Eugene
Lufkin Rule Co.
Lussky, White & Coolidge, Inc.
Post Company, Frederick
Stanley Tools
Starrett Co., L. S.
Weber Company, F.
SANDERS, BELT
Boice-Crane Co.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Yates-American Machine Co.
SANDERS, COMBINATION
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Skilsaw, Inc.
Walker-Turner Co., Inc.
Yates-American Machine Co.
SANDERS, DISK
Atlas Press Co.
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Wallace & Co., J. D.
Walker-Turner Co., Inc.
SANDERS, DRUM
Boice-Crane Co.
Delta Mfg. Co.
Walker-Turner Co., Inc.
Yates-American Machine Co.
SANDERS, PORTABLE
Boice-Crane Co.
Carter Div., R. L.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Skilsaw, Inc.
Stanley Works
SANDERS, SPINDLE
Boice-Crane Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Wallace & Co., J. D.
Yates-American Machine Co.
SANDPAPER
Behr-Manning Corp.
Carborundum Co., The
Lussky, White & Coolidge, Inc.
SAW FILER
Atkins & Co., E. C.
Foley Manufacturing Co.
SAW FRAMES, JEWELERS'
SAW SETS
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
Woodworker's Tool Works
SAW TRIMMERS (PRINTING)
American Type Founders Sales Corp.
Atkins & Co., E. C.
SAWS, CIRCULAR, BAND AND HACK
Atkins & Co., E. C.
Black & Decker Mfg. Co.
Burrill Saw & Tool Works
Boice-Crane Co.
Brodhead-Garrett Co.
Crescent Machine Co.
Delta Mfg. Co.
Disston & Sons, Inc., Henry
Huther Bros. Saw Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Starrett Co., L. S.
Walker-Turner Co., Inc.
Woodworker's Tool Works
SAWS, PORTABLE ELECTRIC
Black & Decker Mfg. Co.
Skilsaw, Inc.
Stanley Electric Tools
SCHOOLS
Bradley Polytechnic Institute
Oregon State Agricultural College
Pennsylvania State College
University of Minnesota
SCRAPERS, HAND AND CABINET
Atkins & Co., E. C.
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Smith, Inc., Landon P.
Stanley Tools
Starrett Co., L. S.
SCREW CLAMPS
Adjustable Clamp Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
SCREW DRIVERS
Lussky, White & Coolidge, Inc.
Millers Falls Co.
North Brothers Mfg. Co.
Stanley Tools
Starrett Co., L. S.
SCREW DRIVERS, ELECTRIC
Black & Decker Mfg. Co.
Stanley Electric Tools
SCREW MACHINES, HAND
Rivett Lathe & Grinder Corp.
SCROLL SAWS
Atkins & Co., E. C.
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Walker-Turner Co.
Wallace & Co., J. D.
SEMI-PRECIOUS STONES
Metal Crafts Supply Co.
SHAPERS, ELECTRIC
Boice-Crane Co.
Carter, R. L., Div.
Stanley Electric Tool Co.
SHAPERS, METAL
Atlas Press Co.
Rhodes Mfg. Co.
SHAPERS, WOODWORKING
Boice-Crane Co.
Carter, R. L., Div.
Crescent Machine Co.
Delta Mfg. Co.
Lewis Machine Tool Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Walker-Turner Co., Inc.
Wallace & Co., J. D.
Yates-American Machine Co.
SHARPENING STONES
Behr-Manning Corp.
Carborundum Co., The
Lussky, White & Coolidge, Inc.
Norton Abrasive (Behr-Manning)
SHEARS AND SCISSORS, FOR CUTTING METALS
Black & Decker Mfg. Co.
Schollhorn Co., Wm.
SHEET METAL EQUIPMENT AND SUPPLIES
SHELVING, STEEL
SHOWER STALLS
Bradley Washfountain Co.
SILK SCREEN SUPPLIES
SILVERSMITHS' TOOLS AND SUPPLIES
Metal Crafts Supply Co.
SKETCH BLOCKS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.
SLIDE RULES
Dietzgen Co., Eugene
Post Company, Frederick
SLOTTERS
Rhodes Mfg. Co.
SLOYD KNIVES
Atkins & Co., E. C.
Lussky, White & Coolidge, Inc.
SOCKETS AND RECEPTACLES
General Electric Co.
SOLDERING COPPERS
Lussky, White & Coolidge, Inc.
SOLDERING FURNACES
American Gas Furnace Co.
Chicago Flexible Shaft Co.
General Electric Co.
Johnson Gas Appliance Co.
SOLDERING IRONS, ELECTRIC
General Electric Co.
Lussky, White & Coolidge, Inc.
Stanley Tools
SOLDERING SOLUTIONS
Ruby Chemical Company
SOLDERING TORCHES
SOLDERS, ALL KINDS
Atkins & Co., E. C.
Kester Solder Co.
Ruby Chemical Company
SOLDERS, FLUX FILLED
Kester Solder Co.
Ruby Chemical Company
SPECIAL AUTO MECH. TOOLS
Armstrong Bros. Tool Co.
Black & Decker Mfg. Co.
K-D Manufacturing Co.
Millers Falls Co.
Snap-On Tools Corp.
Stanley Tools
Starrett Co., L. S.
SPINDLE CARVERS
Oliver Machinery Co.
Yates-American Machine Co.
SPINNING EQUIPMENT & TOOLS
Atlas Press Co.
Boice Crane Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
SPOKESHAVES
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
SPRAY PAINTING BOOTHS
DeVilbiss Co.
SPRAY PAINTING EQUIPMENT
DeVilbiss Co.
SQUARES, BEVEL
Millers Falls Co.
Stanley Tools
SQUARES, FRAMING
Millers Falls Co.
Stanley Tools
SQUARES, MITER
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
SQUARES, TRY
Disston & Sons, Inc., Henry
Lussky, White & Coolidge, Inc.
Starrett Co., L. S.
STAKES, ARTS AND CRAFTS
STAMPS, Letters and Figures
Atlas Press Co.
Lussky, White & Coolidge, Inc.
STANDARD CELLS
Weston Electric Instrument Corp.
STARTERS, MOTOR, Electric
General Electric Co.
STEEL RULES
Atkins & Co., E. C.
Dietzgen Co., Eugene
Lussky, White & Coolidge, Inc.
Post Company, Frederick
Starrett Co., L. S.
STEEL SHEETS
STEEL SQUARES
Dietzgen Co., Eugene
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Post Company, Frederick
Stanley Tools
Starrett Co., L. S.
STENCIL KNIVES
STONES, OIL, for Polishing
STOOLS
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.
STORAGE BATTERY TESTING INSTRUMENTS
Weidenhoff, Inc., Joseph
Weston Electric Instrument Corp.
STORAGE, LOCKERS, CABINETS, ETC.
SWING SAWS
Wallace & Co., J. D.
SWITCHBOARD INSTRUMENTS, INDICATING
General Electric Co.
Weston Electric Instrument Corp.
SWITCHBOARDS
General Electric Co.
Weston Electric Instrument Corp.
SWITCHBOXES
General Electric Co.
SWITCHBOXES, OUTLET
General Electric Co.
SWITCHES, SAFETY
General Electric Co.
SWITCHES, REVERSING
Atlas Press Co.
SWITCHES, SAFETY INCLOSED
General Electric Co.
SWITCHES, SNAP AND PUSH BUTTON, AND PLUG
General Electric Co.
TABLES, DRAFTING
Dietzgen Co., Eugene
Engineering Sales Co.
TABLES, STEEL
TACHOMETERS, ELECTRIC
Weston Electric Instrument Corp.
TACKERS
Star Paper Fastener Co.
TACKS, THUMB, STEEL AND BRASS
Dietzgen Co., Eugene
Lussky, White & Coolidge, Inc.
Post Company, Frederick
TAPE, MEASURING
Dietzgen Co., Eugene
Lussky, White & Coolidge, Inc.
Post Company, Frederick
Weber Company, F.
TAPS & DIES
Armstrong Bros. Tool Co.
Morse Twist Drill & Mach. Co.
TEACHER AGENCIES
Rocky Mt. Teachers Agency
T SQUARES
Dietzgen Co., Eugene
Engineering Sales Co.
Post Company, Frederick
Starrett Co., L. S.
Weber Company, F.
TEMPERING AND DRAWING SALTS
Chicago Flexible Shaft Co.
TENONERS
Crescent Machine Co.
Oliver Machinery Co.
Yates-American Machine Co.
TEST EQUIPMENT, ELECTRICAL
General Electric Co.
Weston Electric Instrument Corp.
THREAD-CUTTING TOOLS
Armstrong Bros. Tool Co.
Atlas Press Co.
South Bend Lathe Works
TONGS
Stanley Electric Tools
Starrett Co., L. S.
TOOL AND CUTTER-GRINDER ATTACHMENTS
Dumore Co., The
Mummert-Dixon Co.
Rivett Lathe & Grinder Corp.
Stanley Electric Tools
TOOL BITS
Atlas Press Co.
Williams & Co., J. H.
TOOL GRINDERS, ELECTRIC
Atlas Press Co.
Delta Mfg. Co.
Millers Falls Co.
Mummert-Dixon Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Walker-Turner Co., Inc.
TOOL GRINDERS, OILSTONE
Oliver Machinery Co.
Mummert-Dixon Co.
Wallace Co., J. D.
TOOL HOLDERS
Armstrong Bros. Tool Co.
Atlas Press Co.
Lussky, White & Coolidge, Inc.
South Bend Lathe Works
Williams & Co., J. H.
TOOL POST GRINDERS
Atlas Press Co.
Chicago Wheel & Mfg. Co.
South Bend Lathe Works
Stanley Electric Tools
TOOL STANDS
TOOL STORAGE EQUIPMENT
TORCHES, Alcohol, Gasoline and Acetylene
Lussky, White & Coolidge, Inc.
TRACING PAPER AND CLOTH
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.
TRANSFORMERS
General Electric Co.
TRIANGLES
Dietzgen Co., Eugene
Post Company, Frederick
Weber Company, F.
TROWELS, PLASTERING, CEMENT, POINTING
Disston & Sons, Inc., Henry
Stanley Tools
TUBING RUBBER
TYPE FOUNDERS
American Type Founders Sales Corp.
TYPE GAUGES
American Type Founders Sales Corp.
UNIVERSAL SAW BENCHES
Crescent Machine Co.
Oliver Machinery Co.
Yates-American Machine Co.
UPHOLSTERY MATERIALS AND SUPPLIES
Lussky, White & Coolidge, Inc.
VALVE GRINDING COMPOUND
Carborundum Co., The
VALVE GRINDING EQUIP.
Black & Decker Mfg. Co.
VARIETY SAW BENCHES
Oliver Machinery Co.
Wallace & Co., J. D.
Yates-American Machine Co.
VENEER
Brodhead-Garrett Co.
Giles & Kendall Co.
Tecce Lumber Co.
VISES, BENCH
Abernathy Vise & Tool Co.
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Morgan Vise Co.
Williams & Co., J. H.
VISES, BLACKSMITHS'
Atlas Press Co.
Columbian Vise & Mfg. Co.
VISES, MACHINE
Armstrong Bros. Tool Co.
Atlas Press Co.
North Brothers Mfg. Co.
VISES, PIPE
Armstrong Bros. Tool Co.
Atlas Press Co.
Columbian Vise & Mfg. Co.
Morgan Vise Co.
VISES, SAW
Atkins & Co., E. C.
VISES, WOODWORKERS'
Abernathy Vise & Tool Co.
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
Morgan Vise Co.
VISUAL EDUCATION
National Audio Visual Council, Inc.
Society for Visual Education, Inc.
VOLTMETERS
General Electric Co.
Weston Electric Instrument Corp.
WASHFOUNTAINS
Bradley Washfountain Co.
WATERPROOF SANDPAPER
Behr-Manning Corp.
Carborundum Co., The
Norton Abrasive (Behr-Manning)
WATTMETERS
General Electric Co.
Weston Electric Instrument Corp.
WEAVING MATERIALS
Hammett Co., J. L.
WELDING EQUIPMENT, ELECTRIC
Eisler Engineering Co.
General Electric Co.
Hobart Brothers Co.
Marquette Manufacturing Co.
WELDING EQUIPMENT, OXYACETYLENE
Air Reduction Sales Co.
Union Carbide & Carbon Corp.
WELDING TORCHES
American Gas Furnace Mfg. Co.
WOOD CARVING
Lussky, White & Coolidge, Inc.
WOOD FINISHING MATERIALS
General Finishes Sales & Service Co.
Lussky, White & Coolidge, Inc.
WOOD FORMS AND BLOCKS FOR BOWL & TRAY MAKING
WOOD TRIMMER
Oliver Machinery Co.
WOOD-TURNING LATHES
Atlas Press Co.
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Walker-Turner Co.
Wallace & Co., J. D.
Yates-American Machine Co.
WOODWORKING LATHES
Atlas Press Co.
Boice-Crane Co.
Delta Mfg. Co.
Walker-Turner Co., Inc.
WOODWORKERS' VISES
Atlas Press Co.
Cincinnati Tool Co.
Columbian Vise & Mfg. Co.
Lussky, White & Coolidge, Inc.
Morgan Vise Co.
WOODWORKING MACHINES, COMBINATION
Boice-Crane Co.
Crescent Machine Co.
Delta Mfg. Co.
Oliver Machinery Co.
Porter-Cable Machine Co.
Stanley Electric Tools
Tannewitz Works, The
WOODWORKING SHAPERS
Boice-Crane Co.
Carter, R. L., Div.,
Delta Mfg. Co.
Oliver Machinery Co.
Walker-Turner Co., Inc.
Yates-American Machine Co.
WOODWORKING TOOLS AND SUPPLIES
Brodhead-Garrett Co.
Chicago Wheel & Mfg. Co.
Lussky, White & Coolidge, Inc.
Millers Falls Co.
Stanley Tools
WRENCHES, BOXOCKET
Armstrong Bros. Tool Co.
Snap-On Tools Corp.
Williams & Co., J. H.
WRENCHES, IGNITION
Armstrong Bros. Tool Co.
Lussky, White & Coolidge, Inc.
Snap-On Tools Corp.
Williams & Co., J. H.
WRENCHES, OPEN END
Armstrong Bros. Tool Co.
Snap-On Tools Corp.
Williams & Co., J. H.
WRENCHES, PIPE
Armstrong Bros. Tool Co.
Lussky, White & Coolidge, Inc.
Snap-On Tools Corp.
Williams & Co., J. H.
WRENCHES, SOCKET
Armstrong Bros. Tool Co.
Black & Decker Mfg. Co.
Cincinnati Tool Co.
Snap-On Tools Corp.
Starrett Co., L. S.
Williams & Co., J. H.
WRENCHES, VALVE TAPPET
Armstrong Bros. Tool Co.
Cincinnati Tool Co.
Snap-On Tools Corp.
Williams & Co., J. H.
WROUGHT IRON



We manufacture a complete line of equipment:
COLLEGE GLASS working units for students and laboratory. SPOT WELDERS and A. C. ARC WELDERS. TRANSFORMERS, special and standard types, INCANDESCENT LAMP manufacturing equipment. RADIO TUBES, ex-ray, cathode ray, photo cells. ELECTRONIC EQUIPMENT, vacuum pumps, etc. NEON UNITS, blow torches and burners of all kinds. GENERAL GLASS working machines and ribbon burners.

EISLER ENGINEERING CO.
CHAS. EISLER
767 So. 13th St. (Near Avon Ave.) Newark, New Jersey

The Same

DEPENDABILITY

Year After Year

Catalog free to Instructors

FRANK PAXTON LUMBER CO.
DES MOINES — DENVER
FORT WORTH — KANSAS CITY

100's Industrial Arts Teachers Needed
For Good Paying Positions
Throughout the West and Middle West
FREE ENROLLMENT
Largest In The West
Wm. Ruffer, Ph.D., Manager

ROCKY MT. TEACHERS AGENCY
410 U.S. Nat Bank Bldg. Denver, Colo.

Materials for Brush Making

Brush Fibres, Tampico, Fibre Mixtures, Sterilised Horse Hair. Hair, Bristle and Tampico mixtures solid or taper stock, original lengths cut to size. *Samples matched.*

E. B. & A. C. WHITING CO.
Burlington, Vermont

FILMS TO HELP WIN THE WAR

New free catalog of recently released films on AVIATION, DEFENSE AND WAR TRAINING.

BRANDON FILMS 1600 Broadway New York City

BOOKBINDING EQUIPMENT AND SUPPLIES
Write
G. A. PRATT
4133 Northcote Ave. East Chicago, Indiana

STA-WARM TRIPLEX
3 Heat Glue Pot

A low cost, high efficiency quality Electric Glue Pot with 3 heating control —
1. Low—for intermittent use.
2. Med.—for continuous use.
3. High—for quick heating.

Write for details on its 17 advantages.
1 pt. - $6.75
1 qt. - 7.25
2 qt. - 9.25
Details also available on other Sta-Warms, 1 pt. to 8 qt., with automatic control.

STA-WARM ELECTRIC CO., Ravenna, Ohio
Rep. by Oliver Machy. Co., Gr. Rapids, Mich.

Free

For Your Classroom

Two-color Wall Chart, 22" x 34", "Know Your Blow Torch". Shows how to light a blow torch plus safety hints in fourteen 4" x 5" action pictures. Just send a penny post card to Department VE.

TURNER BRASS WORKS
Sycamore, Illinois

Archery Materials

The L. C. Whiffen semi-finished 5 foot 8 inch lemonwood bows pulling up to 40 pounds have proved their excellence for use as an educational and useful project. . . . Send for a trial set. You will be enthusiastically surprised.

Complete Set Bow—6 arrows Semi-Finished **$1.98**

L. C. WHIFFEN CO., Inc.
828 W. Clybourn St. Milwaukee, Wis.

LOOMS, Table and Foot
Reed, Raphia, Handicraft Supplies

Send for catalog

J. L. HAMMETT CO.
CAMBRIDGE, MASS.

LEATHERCRAFT

Everything in **LEATHER**

A *complete* line of leathers, tools, accessories, patterns, instructions, etc. Guaranteed quality—lowest prices. New white moccasin Kits—ideal for boys and girls.

Write today for free 84-page Catalog No. 1A!

OSBORN BROS., 223 Jackson Blvd., Chicago, U.S.A.

Pottery and Ceramic Supplies

Modeling and Pottery Clays . . . Glazes, Modeling Tools, Kilns and Potters' Wheels, etc.

Catalog on request

CERAMIC ATELIER
923 N. La Salle St. Chicago, Ill.

Instructors
SEND FOR
NEW No. 18
CATALOG
OF
RED DEVIL TOOLS

72 pages in color

LANDON P. SMITH, INC.
IRVINGTON, N. J.
Manufacturer of the world's famous Red Devil glass cutters

CRAFTSMANUAL
FREE
WITH BIG INTRODUCTORY PACKAGE OF MONITE WATERPROOF GLUE

Send 25c to
Monite Waterproof Glue Co.
Monite Bldg. Minneapolis, Minn.

Electro-Typers

Especially qualified to be of service to the school printshop.

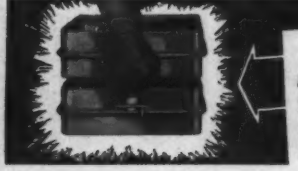
Promptness and quality assured.

Forms returned same day received.

Badger - American Electrotype Co.
600 Montgomery Bldg.
407 East Michigan St., Milwaukee, Wis.

ELECTRIC
MOTOR PARTS
FOR ALL MAKES

ALSO ALL MATERIALS AND TOOLS USED IN THE MOTOR REPAIR SHOP
Free Catalogue to Instructors
READING ELECTRIC CO., Inc.
200 William St., New York



Sterling **STEEL FLASKS FOR ACCURACY**
Made of special rolled steel channel-sections (copper bearing, rust-resisting) with solid center reinforcing rib, square flanges, full width bearing. WRITE FOR CATALOG of FLASKS and other STERLING FOUNDRY EQUIPMENT.
STERLING WHEELBARROW CO., Milwaukee, Wis.

DRAWING MATERIALS

WEBER
Trade Mark Reg. U.S. Pat. Off.

▼ WATERPROOF DRAWING INKS
▼ STUDIO, SCHOOL AND DRAFTING ROOM FURNITURE
ARTISTS' COLORS AND MATERIALS

Catalog Vol. 700 to Teachers and Schools on request.

PATRONIZE YOUR NEAREST WEBER DEALER

F. WEBER CO.
Manufacturing Artists' Colormen Since 1853
PHILADELPHIA, PA.
St. Louis, Mo. Baltimore, Md.

BRADLEY
POLYTECHNIC INSTITUTE
PEORIA, ILLINOIS
A "WAR-TIME" SUMMER SESSION
THREE TERMS OF 30 DAYS EACH
1943
MAY 3 — JUNE 11 JUNE 14 — JULY 17
JULY 19 — AUGUST 21
Attend one, two, or three terms
Courses for Teachers of Industrial Arts, Commercial, Home Economics, Music, Art, High and Elementary School Subjects, Engineering and Liberal Arts
Send for Catalog
ALBERT F. SIEPERT
DIRECTOR OF THE SUMMER SESSION

Have You Seen **X-acto . . .**
the INTERCHANGEABLE KNIFE

X-acto is different than ordinary knives . . . the blade is interchangeable. Handles furnished with 8 varied shapes for various uses. Extra blades attractively priced for economy. Made of surgeons' steel.

Write for catalog and sample offer.

X-acto Crescent Products Co., Inc.
440 - 4th Avenue
New York, N. Y

PATTERSON BROTHERS
"a mecca for the mechanically minded"

15 PARK ROW
opp. Woolworth Bldg.
NEW YORK CITY
Ba 7-8320

- General Shop Equipment
- Metals—Brass-Copper-Pewter
- Jewelers Supplies
- Power Machinery
- Hardware
- "Hard To Get" Items.

● For many years we have enjoyed the confidence of the schools and colleges in the east. May we have the opportunity to quote on your requirements?

If Its A Tool Used In School — We Have It

THE METAL CRAFTS

are somewhat curtailed in school programs but we can still furnish some tools and supplies.

25 YEARS OF
DEPENDABLE SERVICE
is your guarantee for 1943

Our catalog IA showing hammers, anvils, silver, enamels, etching materials, stones, findings, books and portfolios sent free to Industrial Arts teachers who state school connection.

METAL CRAFTS SUPPLY COMPANY
10 Thomas Street Providence, R. I.

THIS TRADEMARK
Means Modern, Efficient Drafting Equipment!

The ESCO Trademark on Equipment for the Drafting Room signifies modern construction, efficient operation and a 100% guarantee of satisfaction.

ESCO Products are used regularly in the drafting rooms of practically all major war industries and engineering schools. We are proud to be doing our part in the present "all out" war effort by supplying these important drafting rooms with the equipment necessary to efficiently carry on their work.

Write for Catalog 2-A illustrating and describing Plastic T-Squares Plastic Straightedges, Drawing Tables, Drawing Kits, etc.

ENGINEERING SALES COMPANY
Dept. 243 — SHEBOYGAN, WISCONSIN

BALDOR
ELECTRICAL SPECIALISTS
for 22 YEARS
Manufacturers of
ELECTRIC MOTORS
ELECTRIC MOTOR GRINDERS
BATTERY CHARGERS
FAST BATTERY CHARGERS
BATTERY TESTERS
Write for Bulletins
BALDOR ELECTRIC COMPANY
4325 Duncan Ave., ST. LOUIS, MO.

BALDOR builds a Complete Line of Electric Grinders—bench and pedestal types—6" to 12". Above is grinder No. 803. ½ h.p. 3400 r.p.m. 110 volts, 60 cy., Capacitor type, $60.00.

BALDOR ELECTRIC CO.
4325 Duncan Ave., St. Louis, Mo.

MARQUETTE
REG. U.S. PAT. OFF.
A.C. ARC WELDERS

MARQUETTE MFG. CO., INC. MINNEAPOLIS, MINNESOTA.

HIGGINS AMERICAN DRAWING INKS
Precision Inks for Precise Performance
From the steamy dampness of the tropics to the icy dryness of the arctic, experienced draftsmen insist on Higgins American Drawing Inks. For they know they can depend on the precise performance of Higgins Inks under all working conditions.
For more than 63 years Higgins American Drawing Inks have been winning world-wide respect for their superior qualities — for free flow and sharp surety of line. Draftsmen know that with reasonable care Higgins American Drawing Inks retain their qualities of precision performance unless actually exposed to freezing.
Available in a complete color range.
HIGGINS
HIGGINS INK CO., INC.
271 NINTH ST., BROOKLYN, N. Y.

INDEX TO ADVERTISEMENTS

Adjustable Clamp Company 85A
Air Reduction Sales Co. 19A
Allied Radio Corp. 90A
American Art Clay Company 93A
American Gas Furnace Co. 93A
American Technical Society 98A
American Type Founders Sales Corp. 75A
Armstrong Bros. Tool Co. 33A
Atkins and Company, E. C. 57A
Atlas Press Company, The 29A

Badger-American Electrotype Co. 95A
Baldor Electric Company 96A
Black & Decker Mfg. Co., The 7A
Boice-Crane Company 62A
Bradley Polytechnic Institute 96A
Bradley Washfountain Co. 44A
Brandon Films 95A
Brandtjen & Kluge, Inc. 98A
Brodhead-Garrett Co. 73A
Bruce Publishing Company, The. 83A, 3rd cover
Burrill Saw & Tool Works 88A

Campbell Co., M. L. 85A
Carborundum Company, The 31A
Carter Div., R. L. 53A
Casein Company of America 85A
Ceramic Atelier 95A
Chicago Flexible Shaft Co. ..... 8A & 9A
Chicago Wheel & Mfg. Co. 93A
Cincinnati Milling Machine Co., The 27A
Cincinnati Tool Company 30A
Columbian Vise & Mfg. Co. 35A
Crescent Machine Co., The ..... 10A & 11A

Delta File Works 60A
Delta Manufacturing Company ..48A & 49A
Dick Company, A. B. 1A
Dietzgen Company, Eugene ..... 2nd cover
Ditto, Incorporated 55A
Dixon Crucible Co., Joseph 77A
Driscoll & Co., Martin 93A
Dumore Company, The 34A

Eagle Pencil Company 79A
Eberhard Faber Pencil Co. 71A
Eisler Engineering Co. 95A
Engineering Sales Company 96A

Foley Lumber Company, T. A. 98A
Foley Manufacturing Co. 65A

Franklin Glue Company 88A

General Electric Company 41A
General Finishes Sales & Serv. Co. 56A
Giles & Kendall Co. 93A
Gill Products Co. Inc. 93A

Hammett Company, J. L. 95A
Heath and Company, D. C. 80A
Heller Bros. Company 22A
Higgins Ink Co., Inc. 97A
Hobart Brothers Company 32A
Huther Bros. Saw Mfg. Co. Inc 64A

International Textbook Co. 76A

Johnson Gas Appliance Co. 87A

K. D. Manufacturing Co. 89A
Kearney & Trecker Corp. ..... 5A & 21A
Kempsmith Machine Company 18A
Kester Solder Company 42A

LeBlond Machine Tool Co., R. K. ... 4th cover
Lewis Machine Tool Co. 90A
Lufkin Rule Company, The 13A
Lussky, White and Coolidge 90A

Manual Arts Press 72A
Marquette Manufacturing Co. 96A
McGraw-Hill Book Co., Inc. 12A
Metal Crafts Supply Co. 96A
Millers Falls Company 46A
Monite Waterproof Glue Co. 95A
Morgan Vise Company 58A
Morse Twist Drill & Machine Co. 6A
Motor 38A
Mummert-Dixon Co. 90A

National Audio-Visual Council, Inc. 78A
Nicholson File Company 16A
North Brothers Mfg. Co. 52A

Oliver Machinery Co. 59A
Osborn Bros. 95A

Patterson Bros. 96A
Paxton Lumber Co., Frank 95A
Peerless Machine Company 25A
Plumb, Inc., Fayette R. 66A
Porter-Cable Machine Co. 61A
Pratt, G. A. 95A

Racine Tool & Machine Co. 4A
Reading Electric Company, Inc. 95A
Rhodes Mfg. Co. 88A
Rocky Mt. Teachers Agency 95A
Rivett Lathe & Grinder Corp. 24A
Ruby Chemical Company 87A
Russell Electric Company 93A
Russell-Jennings Mfg. Co. 87A

Schollhorn Co., Wm. 87A
Sheldon & Company, E. H. 73A
Sheldon Machine Co., Inc. 47A
Silver Burdett Company 84A
Skilsaw, Inc. 63A
Smith, Inc., Landon P. 95A
Snap-On Tools Corp. 37A
Society for Visual Education, Inc. 86A
South Bend Lathe Works ..... 2A & 3A
Stanley Electric Tools Div. 45A
Stanley Tools 51A
Star Paper Fastener Co. 85A
Starrett Co., L. S. 20A
Sta-Warm Electric Co. 95A
Sterling Wheelbarrow Co. 95A

Tannewitz Works, The 73A
Testor Chemical Company 69A
Tegge Lumber Co., The 88A
Turner Brass Works, The 95A

Union Carbide and Carbon Corp. 23A
University of Minnesota 84A

Victoray Corporation 54A

Walker-Turner Co., Inc. 67A
Wallace Company, J. D. 80A
Weber Company, F. 96A
Weidenhoff, Inc., Joseph 39A
Western States Envelope Co. 70A
Western Stoneware Co. 93A
Weston Electrical Instrument Co. 43A
Whiffen Co., Inc., L. C. 95A
Whiting Co., E. B. & A. C. 95A
Wiley & Sons, Inc., John 86A
Williams and Co., J. H. 28A
Woodworkers' Tool Works 93A

X-acto Crescent Products Co. Inc. 96A

Yates-American Machine Co. ..... 14A & 15A

PRE-INDUCTION TEXTS

● We have co-operated with the U. S. Office of Education and the Pre-Induction Training Center of the War Department by publishing the following 3 NEW texts and workbooks. We have closely followed the outlines given us by the Office of Education and the War Department. The texts are up-to-date, clearly written by authorities with years of experience, splendidly illustrated and durably and handsomely bound in cloth. They are ideally adapted for use in school classrooms.

Fundamentals of Electricity	**$2.00**
Workbook	**.50**
Fundamental Shop Training	**2.00**
Workbook	**.50**
Fundamentals of Machines	**2.00**
Workbook	**.50**

● In preparing this text material, the American Technical Society was aware of the fact that many high schools would be faced with a serious shortage of qualified teachers to start preinduction training classes.

● Therefore, a spiral bound "consumable" work book has been published to accompany each one of the above texts. This work book will contain not only laboratory and project problems but also a complete classroom study program developed along an exclusive plan known as the "Six Step Plan of Training." This plan has grown out of our many years of experience in teaching. Under this Six Step Plan the teacher will have at his or her immediate disposal a completely worked out classroom program.

● We will be pleased to send any of these texts and work books for 30 days on approval examination subject to our regular educational discount if retained. In this manner you can actually see for yourself how well adapted these NEW books are to your Pre-Induction program. Fill in the coupon below and send it in by return mail.

OTHER RECENT TEXTS

These modern texts have been especially prepared for school use. You can employ them to excellent advantage in your Victory Training Program as well as your regular program. An examination will convince you of their suitability to your classroom needs. Any books sent for 30 days ON APPROVAL inspection subject to our educational discount if retained.

Dunwoody Arc Welding Unit	**$1.25**
Dunwoody Gas Welding Unit	**1.25**
Aerial Navigation	**0.75**
Mechanical Drawing	**2.00**
How To Plan a House	**4.50**
How To Remodel A House	**4.75**
Plane Trigonometry Made Plain	**2.75**
Metallurgy	**2.50**
Shipbuilding Blueprint Reading	**3.00**
Tool Design	**4.50**
Machine Trades Blueprint Reading	**2.00**
Plastics	**3.00**
How To Read Electrical Blueprints	**3.00**
‡Flight—First Principles	**2.50**
‡Flight—Aviation Engines	**3.25**
‡Flight—Meteorology and Aircraft Instruments	**3.25**
‡Flight—Construction and Repair	**2.50**
Machine Shop Work	**3.50**

‡Note: These books have been listed in Leaflet No. 63 issued by U. S. Office of Education

(TEAR OFF HERE AND MAIL TO US)

AMERICAN TECHNICAL SOCIETY
Drexel Ave., at 58th St., Chicago, Dept. HS — 152

Please send the following texts for 30 days ON APPROVAL examination. I will either return them at the end of that time or remit less your educational discount.

_____

_____

_____

Name _____

School _____

School Address _____

Detroit Public Library

LUMBER

For Every School Shop

58 Years Experience **in Supplying particular customers assures you of Quality lumber. The fact that we manufacture our own lumber assures you of reasonable prices. We welcome your inquiries for all items of lumber.**

T. A. FOLEY LUMBER CO.
PARIS, ILL.

WHEN PLANNING
SCHOOL PRINT SHOPS

KEEP IN MIND THE MODERN ALL-PURPOSE PRINTING PRESS . . .

KLUGE AUTOMATIC PRESS

Provides the best foundational training for the student who will ultimately enter the more highly modernized and increasingly mechanized field of Printing.

★

DETAILS GLADLY FURNISHED

★

BRANDTJEN & KLUGE, INC.
ST. PAUL, MINNESOTA

For Preinduction Material, Basic Texts or Project Books—

Bruce Titles of Merit Will Fill Your Needs

Preinduction Material

Fundamentals of Electricity

FUNDAMENTALS OF APPLIED ELECTRICITY, *Jones*

PRACTICAL ELECTRICITY, *Crawford* $1.96

ESSENTIALS OF APPLIED ELECTRICITY, *Jones* $1.36

JOB SHEETS FOR THE PRACTICAL ELECTRICAL SHOP, *Tustison* ....68 cents

Fundamentals of Automotive Mechanics

AUTOMOTIVE ESSENTIALS, *Kuns* $2.32

AUTOMOTIVE SERVICE UNITS, *Kuns*

Volume I—Units: (1) The Service Station (2) Frames, Wheel Suspension, Steering and Ride Control (3) Transmissions, Clutches, Universals, and Front-Wheel Drive (4) Rear Systems and Brakes

Volume II—Units: (1) Power Plants, Oiling and Cooling Systems (2) Engine Repair and Maintenance (3) Fuel and Ignition Systems (4) Automotive Electricity

Each unit, 80 cents

ELEMENTARY PRINCIPLES OF DIESEL-ENGINE CONSTRUCTION $1.80

Fundamentals of Shopwork

Classification of Tools, Common Essential Tools, and Woodworking

TOOL AND MATERIAL IDENTIFICATION CHARTS, *Roehl* ....25 cents
Guide and key, 10 cents

BASIC WOODWORKING PROCESSES, *Hjorth* $1.80

INSTRUCTIONAL UNITS IN HAND WOODWORK, *Brown and Tustison* $1.80

PRINCIPLES OF WOODWORKING, *Hjorth*. $1.76

Metalworking

METALWORK ESSENTIALS, *Tustison and Kranzusch* $1.75

ELEMENTARY WROUGHT IRON, *Bollinger*. $1.48

METALWORK, *Jones* $1.50

AIRCRAFT RIVETING FUNDAMENTALS, *Tabraham* ....32 cents

Wiring and Wire Splicing

JOB SHEETS FOR THE PRACTICAL ELECTRICAL SHOP, *Tustison* ....68 cents

Rope, Splices, and Knots

THE FARMER'S SHOP BOOK, *Roehl* $2.48

Basic and Supplementary

Mechanical Drawing

MECHANICAL DRAWING I and II, *Berg*
Volume I ....64 cents
Volume II ....56 cents
Complete edition....*cloth* $1.42; *paper* $1.12
Teacher's Manual (free on adoption)....10 cents

BLUEPRINT READING FOR THE METAL TRADES, *DeVette and Kellogg*..*Cloth*, $2.50; *paper*, $1.60

Teacher's Key (free on adoption)....25 cents

A PRIMER OF BLUEPRINT READING, *Diamond* ....60 cents

Answer Book (free on adoption) ....10 cents

MECHANICAL DRAFTING HANDBOOK, *Kepler* ....76 cents

Metalworking

AIR CONDITIONING METAL LAYOUT, *Kaberlein* $3.75

OXYACETYLENE WELDING, *Matteson*..72 cents

ELECTRIC WELDING, *Matteson* ....40 cents

MACHINE SHOP PRACTICE, *Jones*
Book I, $2.28; *Book II*, $3.00

COURSE IN SHEET METAL WORK, *Bollinger* $1.20

ELEMENTS OF SHEET METAL WORK, *Welch* $1.50

Woodworking

OPERATION OF COMMON WOODWORKING MACHINES, *Hjorth* $1.72

JOB SHEETS IN HOME MECHANICS, *Tustison*
Set I ....64 cents
Set II ....36 cents

Mathematics

APPLIED MATHEMATICS, *Johnson* $1.60

Answer Book (Free on adoption)

SHOP MATHEMATICS, *Felker* $2.20

Answer Book (Free on adoption) ....30 cents

Printing

PRINTING JOB SHEETS, *Hague*
Set 1, Elementary ....70 cents
Set 2, Advanced ....70 cents

School Shop—Professional

TRADE AND JOB ANALYSIS, *Fryklund*...$1.75

DICTIONARY OF TECHNICAL TERMS
(Newly Revised)
Crispin $2.50

Project Books

Woodworking

YOU CAN WHITTLE AND CARVE, *Hellum and Gottshall* $2.25

MODERNISTIC CHIP CARVING, *Mankin*, *cloth*, $1.75; *paper*, $1.25

SMALL CREATIONS FOR YOUR TOOLS, *Showalter* $2.75

CREATIVE CRATE CRAFT, *Champion* $1.50

WOOD CARVING MADE EASY, *Sowers* ..$1.50

100 PROBLEMS IN WOODWORK, *DeVette*. $2.00

TOYS EVERY CHILD CAN MAKE, *Wright*. $2.50

50 POPULAR WOODWORKING PROJECTS, *Lukowitz* $1.25

BIRDHOUSES, *Champion* $1.50

PERMANENT BIRD HOUSES, *Califf* $1.25

MODEL BOATS FOR JUNIORS, *Horst* $2.00

IT'S FUN TO BUILD MODERN FURNITURE, *Lush* $1.75

MASTER HOMECRAFT PROJECTS, *Raeth*..$2.00

FURNITURE BOYS LIKE TO BUILD, *Shaver*. $3.00

40 PIECES OF FINE FURNITURE, *Hjorth*..$3.00

COLONIAL FURNITURE, *Shea and Wenger*. $3.50

FURNITURE FOR THE AMATEUR CRAFTSMAN, *Harmes* $2.50

25 KITES THAT FLY, *Hunt* ....75 cents

Electricity

ELECTRICAL THINGS BOYS LIKE TO MAKE, *Cook* $2.25

Metalworking

50 METAL-SPINNING PROJECTS, *Reagan and Smith* $1.75

55 NEW TIN-CAN PROJECTS, *Lukowitz* ....*cloth*, $1.25; *paper*, 75 cents

INTERESTING ART-METAL WORK, *Lukowitz* ....*cloth*, $1.00; *paper*, 50 cents

101 METAL-WORKING PROJECTS, *Petersen* $2.25

Handicrafts

INDIANCRAFT, *Hunt* $2.75

INDIAN AND CAMP HANDICRAFT, *Hunt*..$2.50

FUNDAMENTALS OF LEATHERCRAFT, *Cramlet* $1.25

PRACTICAL POTTERY FOR CRAFTSMEN AND STUDENTS, *Jenkins* $2.75

POTTERY MADE EASY, *Dougherty*....$2.50

Write for complete catalog and for copies of these books for thirty days' study.

The Bruce Publishing Company, 703 Montgomery Bldg., Milwaukee, Wis,

You were beyond *us*, Jack. We shook our heads at your zoot suit and your jive talk and your seeming indifference to anything serious. Psychologists said yours was a 'teen age attempt at individualism.

Yet, when you stood grinning in your wrinkled khaki uniform on that station platform surrounded by several hundred other soldiers, you were as much an individual as ever. Tonight you squat in the jungle mud behind a gun. You know that one of the things you fight for is a school system that works to form students of character and away from regimented uniformity.

Give 'em hell, screw ball!'

The R. K. LeBLOND MACHINE TOOL CO., CINCINNATI, OHIO

CHICAGO, 20 N. Wacker Dr
STA 5561

★ *Largest Manufacturer of a Complete line of Lathes* ★

NEW YORK, 103 Lafayette St
CANAL 6-5281

LeBLOND
CINCINNATI, OHIO
U.S.A.